



**San Francisco  
Water Power Sewer**  
Services of the San Francisco Public Utilities Commission

## Robert Louis Stevenson Stormwater Schoolyard

### Improving Our Sewer System and Benefiting the Community

The Robert Louis Stevenson Stormwater Schoolyard Project is the result of a collaboration between the San Francisco Public Utilities Commission (SFPUC) and San Francisco Unified School District (SFUSD). This project marks the beginning of a long-term partnership between the SFPUC and SFUSD to facilitate stormwater management and schoolyard greening in public schools throughout the City of San Francisco. The goals of this project were to create a safe, usable, and fun schoolyard, while reducing impermeable surface and managing stormwater runoff. The newly installed green infrastructure in the Stormwater Schoolyard reduces the rate and volume of stormwater runoff entering our sewer system by diverting runoff from the school's roof and blacktop to dry creek beds and a sunken permeable pavement amphitheater. These green infrastructure features embody the goals of multipurpose infrastructure by enhancing the stormwater performance at the school, while providing a stimulating outdoor space for learning and playing. We anticipate that the RL Stevenson Stormwater Schoolyard will become a model for other schools in the district.



### Project Statistics

**Watershed:** Sunset

**Stormwater Managed:** 476,300 gallons of stormwater each year

**Drainage Area:** 0.91 acres of impervious surface

**Stormwater BMPs:** 1,104 square feet of permeable pavement; 5,176 square feet of dry creek beds (infiltration trenches with surrounding landscaping)

### Additional Improvements

- Creates opportunity to learn about the hydrologic cycle, stormwater management, drought tolerant plants, and green infrastructure through visual "Follow the Drops" and disconnected downspouts.
- Provides opportunities for enhanced nature play through integrated stormwater management and play features.



# STORMWATER SCHOOLYARD PLANNING PROCESS FOR R. L. STEVENSON ELEMENTARY SCHOOL

SAN FRANCISCO PUBLIC UTILITIES COMMISSION



*WITH*

SAN FRANCISCO UNIFIED SCHOOL DISTRICT  
GREEN SCHOOLYARDS AMERICA  
TEICHMANN LANDSCHAFTSARCHITEKTEN  
MILLER COMPANY LANDSCAPE ARCHITECTS



MILLER COMPANY  
landscape architects

December 2017

Report written by Sharon Danks, Green Schoolyards America.  
Photographs by Sharon Danks, unless otherwise noted.

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## INTRODUCTION

School districts are one of the largest land managers in every city across the United States. In California alone, more than 130,000 acres are managed by public school districts. The majority of urban school sites in California, including San Francisco, have a high percentage of land covered by asphalt, concrete, and other impermeable surfaces, which creates significant stormwater runoff and other serious problems for the local environment.

Integrating green infrastructure design for children's school ground landscapes can address needs for improved stormwater management on these public lands—while also creating vibrant, natural environments for children's learning and play and park-like spaces for community engagement. Green schoolyards that include stormwater design add to the ecological resilience of their neighborhoods and improve children's wellbeing.

Stormwater design for children's spaces is in its infancy in the United States, but has been more widely implemented in parts of Europe, including Germany. It is a complex undertaking to balance the technical needs of green infrastructure design and management with effectively designed, flexible, interactive landscapes that provide ideal settings for children's learning and play. The stormwater schoolyards in American cities generally succeed in their stormwater management goals, but often miss the mark in terms of high quality design for children's wellbeing.

In 2014, the San Francisco Public Utilities Commission (SFPUC) and the San Francisco Unified School District (SFUSD) partnered to transform a single SFUSD school site into an innovative "Stormwater Schoolyard" demonstration project. The SFUSD/SFPUC collaboration envisioned a pilot SFUSD Green Schoolyard project that will showcase a large-scale demonstration of green infrastructure technologies and provide several educational opportunities for students to learn about the hydrologic cycle, stormwater management, the City's

wastewater treatment systems, drought tolerant plantings, and the many co-benefits of green infrastructure, such as increased biodiversity. In addition to stormwater management, another goal of the project was to push the envelope on stormwater schoolyard design in the United States, by building a cutting edge example that reflects best practices for children's hands-on learning and play. It is hoped that this project can serve as a model that will raise the bar for future green schoolyard development in San Francisco and beyond.

To accomplish this goal, the SFPUC and SFUSD partnered with nonprofit Green Schoolyards America and renowned landscape architect Birgit Teichmann from Teichmann LandschaftsArchitekten in Berlin, Germany (the Planning Team) to create a model stormwater schoolyard at R. L. Stevenson Elementary School in San Francisco that will include advanced stormwater management features infused with opportunities for dynamic hands-on learning and play.

The Planning Team collaborated with Miller Company Landscape Architects (Design Team), who were contracted to complete the design and oversee construction of the project. The teams worked together to infuse the design process with international best practices for stormwater design in children's landscapes. Teichmann provided input on the design process at a critical phase, in order to help shape the design decisions and contribute her expertise from an outside perspective.

This report is a record of the Planning and Design Teams' work together over the course of a year, from the beginning of the planning process with the school community in October 2016 through the second draft of the schematic plan for the school grounds in October 2017. The end of the report also includes reflections and lessons learned from this project.

## PLANNING TEAM

### SAN FRANCISCO PUBLIC UTILITIES COMMISSION

Rosey Jencks, Watershed Program Manager  
Sarah Bloom, Watershed Planner  
Ken Kortkamp, Stormwater Engineer  
Polly Perkins, Watershed Planner  
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### SAN FRANCISCO UNIFIED SCHOOL DISTRICT

Tamar Barlev, Green Schoolyard Manager  
Diane Lau-Yee, Principal, Stevenson School  
Nik Kaestner, Director of Sustainability  
Lori Shelton, Green Schoolyard Sr. Project Manager

### GREEN SCHOOLYARDS AMERICA

Sharon Danks, Executive Director

### TEICHMANN LANDSCHAFTSARCHITEKTEN

Birgit Teichmann, Owner, Landscape Architect

## DESIGN TEAM

### MILLER COMPANY LANDSCAPE ARCHITECTS

Kyla Burson, Landscape Architect  
George Loew, Landscape Architect  
Jeffrey Miller, Owner, Landscape Architect

## TEACHER AND PARENT PARTICIPATION



Figure 1: Teachers (above) and family members participated in green schoolyard brainstorming sessions.

The success of all green schoolyard transformations rests in part on the degree to which the school community is engaged in the design process. As a design process begins, it is important to spend time working with teachers, parents, and students to understand how they are currently using their grounds, and how they would like to further engage with their landscape in the future. This technique of participatory design helps to ensure that the new green schoolyard resonates with the school community, and is properly integrated with site specific teaching methods and goals. Participation also fosters a sense of stewardship that contributes to keeping the site well maintained in the future.

The Planning and Design Teams met with the school community at Stevenson School several times in Fall 2016 to engage in brainstorming sessions that produced ideas to shape the overall design.

On September 22, 2016, the Planning and Design Teams held a short meeting with the school faculty and the after school program to briefly introduce this project and ask for their insights regarding the current use (or under-use) of the school grounds. This meeting increased the Teams' understanding of the existing site conditions and set the stage for a more in-depth brainstorming session the following month.

On October 20, 2016 Team members from Miller Company and Green Schoolyards America led two longer meetings with the school community. The first meeting included Principal Diane Lau-Yee, the school's faculty, and the environmental literacy teacher from Education Outside, Sarah Minkin. The participants in

the second meeting were members of the PTA. Team members from SFPUC and SFUSD also attended both meetings. Each of the October meetings followed the same format to introduce the participants to the green schoolyard project planned for Stevenson School, and to solicit their input on the direction and design the stormwater schoolyard would take.

At each meeting, Miller Company introduced the green schoolyard project and provided background information about the results of their site analysis, existing conditions, and the opportunities and constraints they had identified. Miller Company also showed examples of local green schoolyard projects. Sharon Danks, Executive Director of Green Schoolyards America, presented a slideshow of schoolyard design ideas and precedents from around the world, with an emphasis on well-established and successful stormwater schoolyards in Europe and Asia.

After presenting stormwater schoolyard concepts and examples, Green Schoolyards America and Miller Company led the participants in a brainstorming session to identify specific green schoolyard elements that they would like to include on Stevenson's school grounds in the future, as well as activities to do with students onsite. At the end of each meeting, the participants were given 4 stickers that they used to vote on ideas that they most strongly supported. The results of this voting session are shown in Figure 2.

Figure 2

## IDEAS FOR THE SCHOOL GROUNDS BRAINSTORMED AND PRIORITIZED BY TEACHERS AND PARENTS

### SCHOOL COMMUNITY IDEAS FROM MEETINGS ON OCTOBER 20, 2016

#### Play Ideas

- More physically challenging play (24)
- Climbing and sliding opportunities/climbing rocks (17)
- Preserve a portion of the yard for ball play (16)
- Places to play quietly/read (10)
- Labyrinth (6)

#### Outdoor Learning

- Outdoor science opportunities (16)
- Vegetable garden (10)
- Outdoor classroom for 20–30 kids/with some type of shelter (8)
- Stage/amphitheater (6)
- Sound garden / outdoor musical instruments (4)
- Compost (1)
- Weather station (1)
- Positive quotes (1)

#### Site Configuration and Comfort

- Shade (18)
- Topography (9)
- Outdoor dining, with quick clean surfaces (4)
- Opportunities for privacy (2)
- Varied ground surfaces (1)
- Redwood grove (1)
- Living wall (1)
- Exposed/visible systems

### ADDITIONAL IDEAS DISCUSSED AT KICK- OFF MEETING ON SEPTEMBER 22, 2016

- Art opportunities, such as chalk drawing on the asphalt
- Children need a greater variety of things to do and more opportunities for exploration and physical challenge
- Yard needs more trees, plants and shade
- Education Outside would like to continue to develop the main garden and outdoor classroom
- The unpaved, raised area at the corner of 34th and Pacheco is underused.
- More spaces for gathering are needed (class size = 20–30 kids)
- More seating is needed for: outdoor dining/picnics; places for kids to read and/or sit in small groups; and a stage/performance area
- Need more places to work on science outside



Figure 3: Teachers and PTA members (above) shared their ideas and voted on their priorities during the meeting on October 20, 2016.

## TEAM DESIGN CHARETTE



### SUMMARY

On January 11, 2017, the Planning and Design Teams for R. L. Stevenson School met onsite with members of the school faculty to collaborate and share their ideas for the schoolyard's transformation through a design charrette. The goal of the design workshop was to support the stormwater schoolyard project by infusing it with an understanding of international best practices for creating engaging environments for children that also incorporate effective and efficient stormwater management features. The workshop was designed to generate ideas that could be incorporated into the master plan and, ultimately, the final site design for the schoolyard.

The design charrette was led by expert landscape architect Birgit Teichmann from Teichmann LandschaftsArchitekten in Berlin, Germany, assisted by environmental planner, Sharon Danks, of Green Schoolyards America. Participants included engineers and project managers from the San Francisco Public Utilities Commission, directors of the green schoolyard and sustainability departments of San Francisco Unified School District, the school principal and teachers from Stevenson School, a staff member from Education Outside, and landscape architects from Miller Company.

Miller Company presented the information they had gathered during their site analysis and used to develop their concept plan for the schoolyard. (See Appendix D) Green Schoolyards America also shared feedback the Planning Team received from parents and teachers

during the previous workshops held earlier in the fall. (See Figure 2) R. L. Stevenson's Principal Diane Lau-Yee shared her hopes and goals for this project and discussed the outcomes the school community would like to see, along with her insights into the ways in which the school site is used throughout the day. Sarah Bloom from SFPUC and Lori Shelton from SFUSD each shared their organization's stormwater management and sustainability goals for the project

After the various stakeholders shared their contributions, Birgit Teichmann gave her presentation on the stormwater schoolyard design principles that her firm follows in Berlin, Germany. Her presentation included vibrant photographs to illustrate how Berlin's schoolyards have created some of the best environments for children that also integrate stormwater management best practices. Teichmann's presentation also included a description



Figure 4 (above): Birgit Teichmann gives her presentation  
Figure 5 (top): The charrette team, hard at work

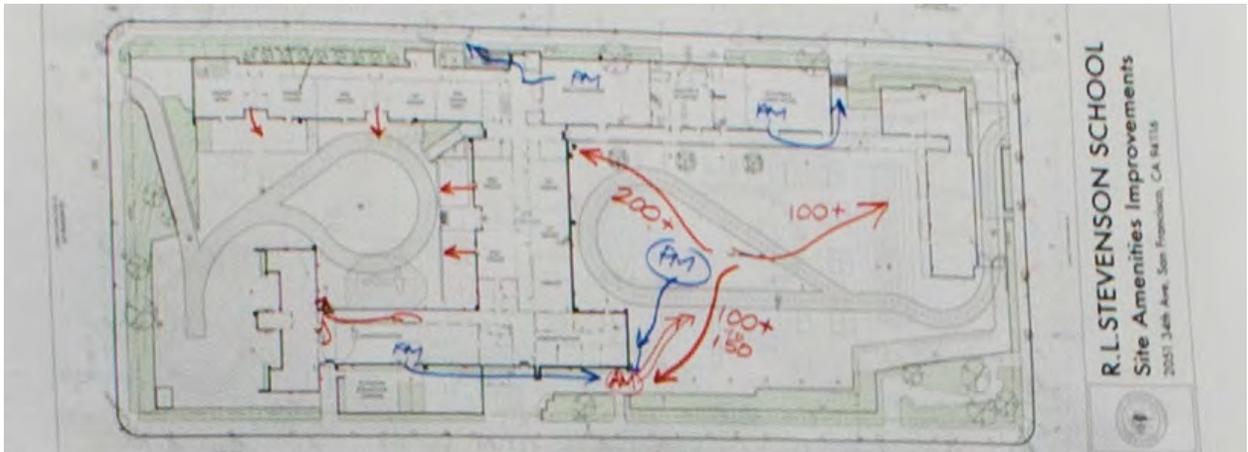


Figure 6 (above): School ground circulation diagram, drawn during the workshop

Figure 7 (three images below): Design workshop in action: collaboration, discussion, and presentation of ideas

of the ways that her firm establishes pathways in their site designs, based on the “desire lines” that the school community uses when they naturally walk across the school grounds. This idea led to an impromptu discussion of the paths of travel on R. L. Stevenson’s school grounds. The principal and a teacher drew their observations of these natural pathways on a base map of the site, to share with the assembled group and help to guide the design thinking. (See Figure 6, above.)



Next, the charette participants split into three groups to create their own designs for Stevenson School’s grounds, using the information about the school community’s needs, the site’s physical characteristics, and best practices for child development and stormwater design. Teichmann circulated between the working groups and engaged with each group in a conversation about their ideas. After the groups created their plans, they shared their ideas with one another.



After the workshop, Birgit Teichmann used the plans the groups created, along with her own observations and understanding of best practices, to create a stormwater schoolyard conceptual plan. See Figure 16 and Appendix C for a drawing and description of this plan.

The following pages include a copy of each group’s drawing and a description of their design ideas for each part of the grounds.



## DESIGN WORKSHOP GROUP #1: DRAWING AND DESCRIPTION OF KEY IDEAS

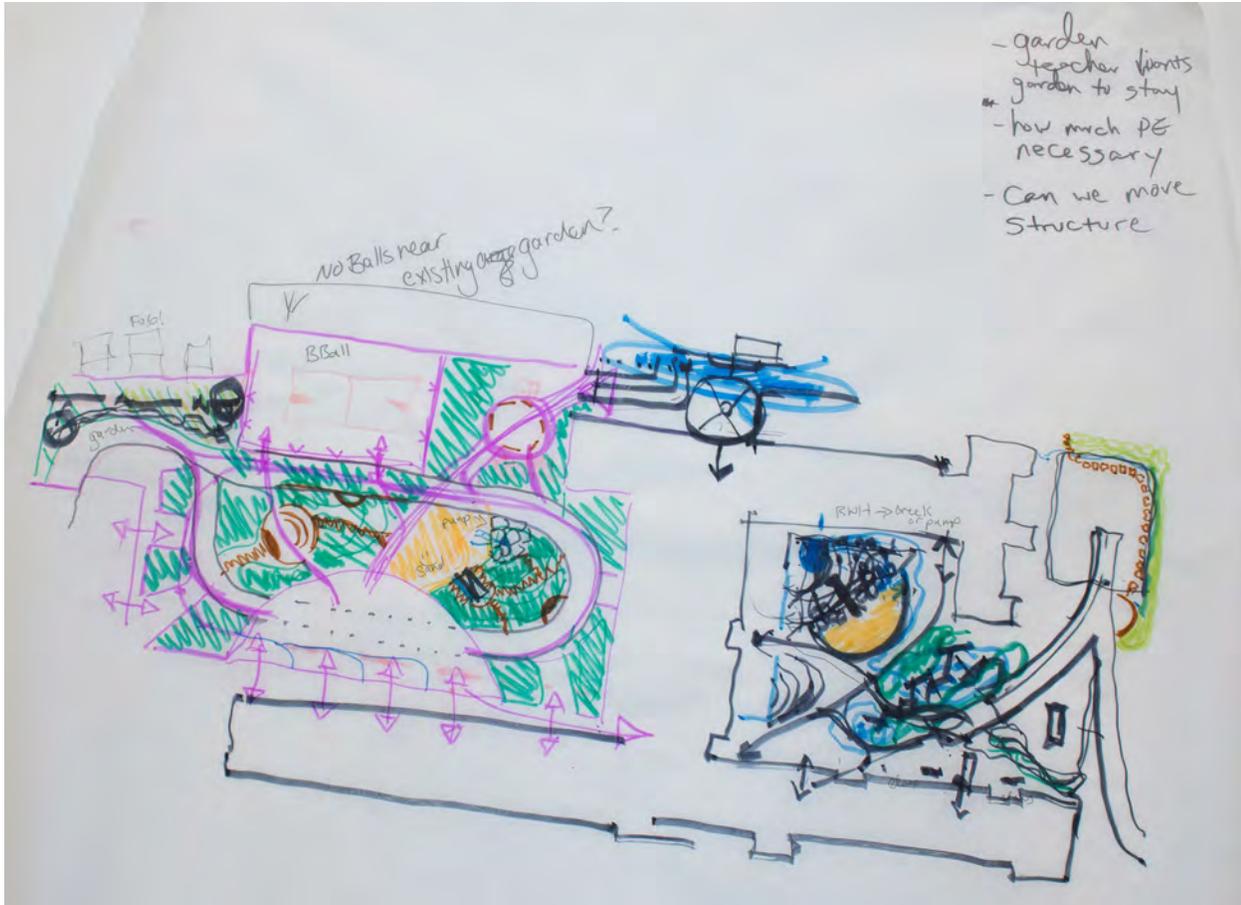


Figure 8: Drawing by Design Workshop Group #1



Figure 9: Members of Group #1, hard at work

### PARTICIPANTS IN GROUP #1

Nik Kaestner (SFUSD), Julie (Stevenson teacher), Jeffrey Miller (MC), Sarah Minick and Polly Perkins (SFPUC)

## HIGHEST PRIORITY

Group #1 noted that the existing fire lanes, determined in a previous phase of the modernization process, greatly constrain the design options since the lanes must be left unobstructed. The group said that their first priority would be to determine whether they can change the alignment of the fire lanes to allow more options.

## NORTH YARD

Group #1 had the following ideas for the North Yard:

- Reconfigure the path of the fire lane to fit the new design that they drew (Figure 8). This will allow the fire truck to move in an oval, around the yard, and still access the building, but would also have other day to day uses. The new fire lane/pathway in their drawing would also serve as the main path of travel within the schoolyard. They also envisioned it as a potential running track for PE classes.
- Build up some topography in the middle areas, within the boundary of the new fire lane path. Add a gathering area next to the building on the west side of the yard.
- Remove asphalt to create a central area that is a “park-like” hilly playscape, with a water play pump and a mound of boulders that will allow the water to cascade down into a large sandbox. The sandbox in the drawing is large enough to fit a whole class. It is scaled for collaborative sand and water play.
- Change the location that the principal stands during morning intake, to accommodate this morning assembly as well as many other school ground uses.
- Move the basketball court to the area where the portables currently are, along the east side, in order to keep the balls separate from the other areas of the schoolyard. Add a fence along the west side of basketball court to help keep the balls inside the basketball zone. This will prevent ball play from interfering with imaginative play, outdoor learning, and other types of social gatherings.
- Create a matrix of small spaces, interspersed within the yard, that will each have a different look

and feel, and different types of views from the hills that will be created in the center of the grounds.

- Incorporate Miller Company’s fog catcher concept on the upper “park” zone, above the fire truck entrance, on the far northeast corner of the site. Collect the fog in a cistern, nestled into the hill, and use the water to irrigate an adjacent garden.
- The school grounds currently have two different gardens. One is run by a teacher, on a hillside behind the portable classrooms. The other is a raised bed garden in front of the school, managed by Education Outside’s staff. Principal Lau-Yee and the teachers would like the existing garden behind the portables to remain where it is, to respect the work of Mr. Williams, the dedicated teacher who created and manages this space. Note: The discussion in the room also touched on the reality that the environmental conditions of the hillside garden space will change when the portables are removed. The sun exposure in that location will dramatically increase. The group proposed helping Mr. Williams to expand the garden and create a “dream garden” that builds on the existing efforts.

## SOUTH YARD

Group #1 had the following ideas for the South Yard:

- Use the configuration of the South Yard to focus on capturing rainwater. Make use of the terraced, elevated area on the north end of this yard as a place to control the water’s flow and capture it in a beautiful way.
- Determine what is really needed for the fire lane in the South Yard, and request changes to the fire lane that will better fit the design. Group #1 feels that the existing fire lane, as drawn, will inhibit the design and shortchange both the stormwater goals and child development needs for outdoor learning and play.
- Create more quiet nooks and crannies within the overall configuration to allow for varied types of learning and play.





Figure 12: Members of Group #2, hard at work

#### PARTICIPANTS IN GROUP #2

Lori Scranton-Snyder and Michelle Low (Stevenson teachers), Tamar Barlev (SFUSD), Ken Kortkamp (SFPUC), George Loew (MC), and Elizabeth Lo (Sandis Engineers)

#### NORTH YARD

Group #2 had the following ideas for the North Yard:

- Reconfigure the designated fire lane to allow for better design opportunities.
- Place the main gathering area in the center of the North Yard (centered north-south), close to the building. This central space will become the primary place for PE and ball play, and it will be wrapped with a newly reconfigured fire lane, that is located somewhat farther away from the building than is shown. They would also like to create an additional ball play area in the space that is currently occupied by the portable classrooms, along 34th.
- Add topography on the south end of this yard and use it to create a ball-free, creative play/quiet play/nature play zone with trees, plants, logs, etc.
- Create a similar nature play/quiet play area near the new building on the north side of the yard to bookend the central gathering space.
- Use boulders to change the topography of many of these spaces, with and without earth mounded around them.
- Include a stormwater runnel that looks like a dry creek bed, along the building. Model this design on the stormwater runnel at Sunset Elementary School. This runnel system will drain toward a wider zone that allows infiltration, in the play area.
- Use the retaining wall (that currently holds the elevated park) to mount different heights of basketball nets. Consider using movable basketball stands, in addition, to allow more flexibility of play in

other areas of the yard. Try to design for multiple ball games/basketball games to occur at the same time.

- Add some climbing holds to the existing retaining wall (below the park) to allow for bouldering/rock climbing.
- Group #2 also asked the other workshop participants a question as they were presenting their idea: “How big should a ball play zone be to accommodate 30 kids?” Answer from the room: “It depends on the age of the children and what they are doing. Ball play during PE is different than ball play at recess, when children just shoot baskets on their own. Shooting hoops takes less space and playing more formal games take more space.”

#### SOUTH YARD

Group #2 had the following ideas for the South Yard:

- Replace the existing rubber surface under the play structure with a permeable material. Add natural play, trees, topography, digging areas, and sand play.
- Create a design that infiltrates stormwater runoff in the center of the site.
- Plan for a ball area in the southeast corner (K area).
- For the Special Education area of the yard: Create a space with pathways that will be useful for rolling toys and tricycles, so that the children can ride their bikes between the plantings and the digging areas. Make sure that their playground has green space, too, and places to dig, play creatively, and use accessible pathways.

DESIGN WORKSHOP GROUP #3: DRAWING AND DESCRIPTION OF KEY IDEAS

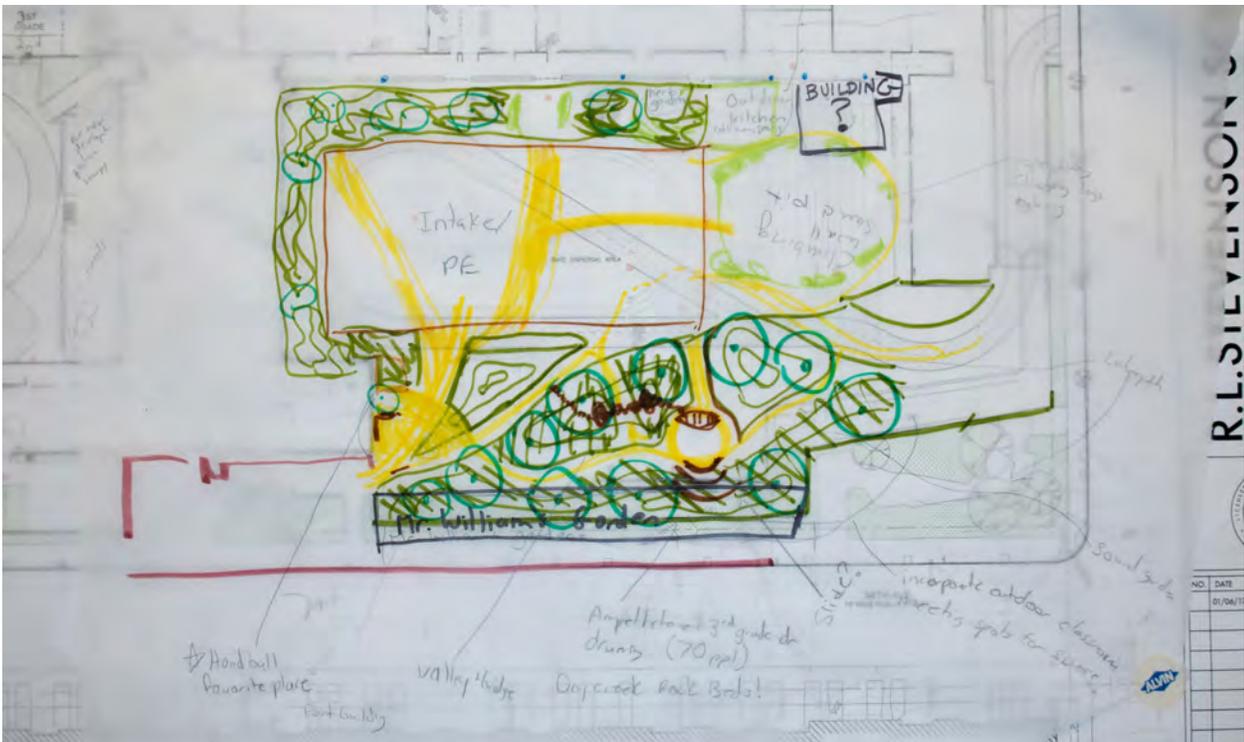
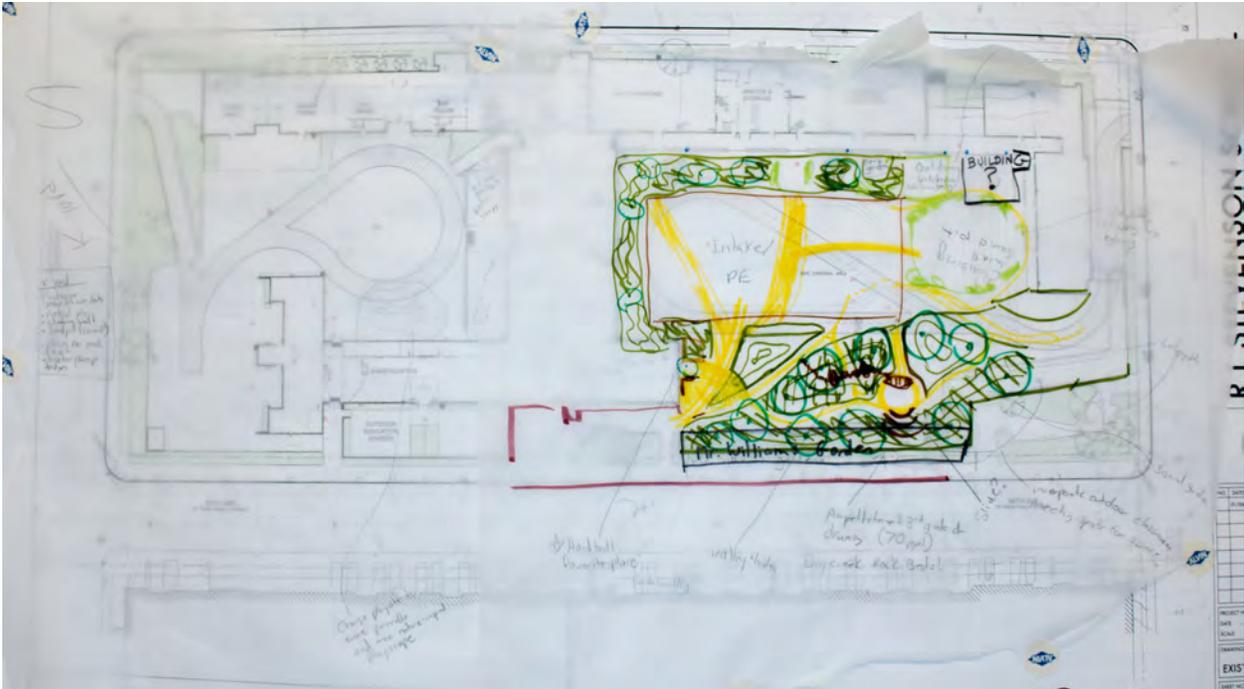


Figure 13 (top) and Figure 14 (bottom): Drawing by Design Workshop Group #3 (top) and detail of that drawing (bottom)

### PARTICIPANTS IN GROUP #3

Diane Lau-Yee (Principal, Stevenson School), Susan Woo and another teacher (Stevenson teachers), Sarah Minkin (Education Outside), Lori Shelton (SFUSD, not shown in this image), Sarah Bloom (SFPUC)



Figure 15: Members of Group #3, in discussion with Birgit Teichmann (center)

### NORTH YARD

- Group #3 reported that they focused their time on the big yard, and considered the mechanics of the intake process and the needs of ball play, in particular. They also mentioned that they reconfigured the fire lane to be able to create this design.
- Their design includes a large central area that is set up for intake and PE, with nature play zones and permeable spaces around the perimeter and also filling the area that is currently occupied by portables. This open space is ringed by greenery and trees.
- The natural spaces on the yard increase in their intensity as they move away from the intake/PE zone, to become hilly and more densely planted on the east side. Shade trees are a key feature of this plan. The plan includes large boulders for sitting on and playing on, and a bridge that crosses a valley in the new topography.
- Outdoor learning areas are integrated into the green spaces in this green schoolyard design.
- Group #3's plan preserves Mr. William's existing garden in its current location, and expands it along the same edge. The plan also shows shade trees nearby, interspersed with the existing garden.

- The plan includes building a new amphitheater for 70 children into the retaining wall near Mr. William's garden. They would also like to add a slide along one side and boulders that would be used for climbing and seating, nearby.
- In the area near the new building, the plan includes an active adventure sand pit/climbing area, for children to get their hearts pumping. It might have a climbing wall in the sand pit, as well.
- Nearby, the group placed an outdoor kitchen with a seating area, herb garden, and cob oven.
- They would also like to add a big play structure to this yard, although the location was not specified in the drawing.
- The plan shows the upper park (at street level) with an added labyrinth, one outdoor classroom space and meeting area, and a sound garden (at the foot of the retaining wall for this park, in the schoolyard).

### SOUTH YARD

- Group #3 would like the design for the South Yard to include playhouses, sand pits with water pumps, places for having snacks, places for imaginative play, and other exciting things for children to explore.

## CONCEPTUAL PLAN BY TEICHMANN LANDSCHAFTSARCHITEKTEN

Landscape architect, Birgit Teichmann GmbH, created a conceptual plan drawing and written description following the design workshop at R. L. Stevenson School. The conceptual plan represents a “best in class” showcase of design intervention that is not constrained by cost or regulatory requirements. The text and images that follow in this section were produced by Teichmann and her firm, Teichmann LandschaftsArchitekten in Berlin, Germany.

### PLANNING PRINCIPLES

This ecological school ground design for R. L. Stevenson School aims to preserve and integrate the existing uses of the schoolyard while adding diversity to the site’s ecology, outdoor program, and functions. This green schoolyard conceptual plan is based on the schoolyard’s usage patterns and existing site characteristics, while integrating complementary topography and green spaces. Teichmann’s conceptual plan maximizes the school’s connection to nature, incorporates stormwater management, adds a wider variety of social play and learning opportunities, and enriches the school grounds with spaces that allow children to be more physically active. This design reflects child development research and contributes to students’ optimal physical development.

Each aspect of the conceptual plan is explained in more detail below.

#### ORGANIZING FRAMEWORK

The green schoolyard conceptual plan is designed to accommodate emergency vehicles by using the existing fire lane as the organizing system for the widest pathways in both yards. The plan also includes a large gathering area for events and school meetings and a fenced ball game field, reflecting the school’s existing use patterns for events and physical education. The plan is also organized around a series of planted hills with smaller pathways that provide alternate connections between each area of the grounds. Together, this modified topography encourages a wider variety of play and learning possibilities, and also includes spaces for relaxation and contemplation. The overall intent is to provide a diversity of experiences and natural atmosphere, using greenery to separate and define different spaces throughout the grounds. This nature-rich

environment is made possible by removing large amounts of asphalt from the school grounds, which also plays a functional role in enabling the schoolyard to infiltrate the majority of the stormwater that falls on the site.

#### MOVEMENT AND HEALTH

The ecological playground conceptual plan is designed to engage children of each grade level in age-appropriate physical challenges and a wide variety of physical play opportunities. This includes spaces for organized games and activities during physical education classes, and opportunities for child-directed (freely chosen) play at recess and before and after school. The pathways allow a number of mobility choices, and the varied topography give children an incentive to increase their physical activity, which promotes and develops their health, coordination, and balance.

The shrubs and trees included in the plan will help to reduce dust in the air, and moderate the climate on the school grounds. Research has shown that trees, shrubs, and other greenery reduce stress levels for adults and children, and contribute to improved mental health. Plants, with their changing colors, varied textures, and fresh scents stimulate the senses, including hearing, sight and touch, and invite children to explore their environment in a manner that improves their vestibular and proprioceptive systems.

#### SOCIAL LEARNING

The reorganization of a school ground from an ecological point of view also engages elements of social cooperation in children. Natural school grounds generate a mosaic of active and quiet spaces, which can be used differently by students for self-determined play. Including students in the design process helps them to identify strongly with the result and gives them greater appreciation for the newly created space. As students participate in the planning and building process for their own schoolyard, they learn to understand the basic ideas that underlie democratic processes. Teachers, students and parents can be involved in the building process and engage directly, for example, by planting shrubs and adding art to the school grounds.

The ecological school ground also offers places for students to play together to promote social competence.

When they are close to nature outside, children pay closer attention to their surroundings, their minds are alert, and their interests in exploration and discovery are awakened.

## SCHOOL GROUND CONCEPTUAL PLAN

### ECOLOGICAL LANDSCAPE

Another goal of this schoolyard design is to reduce the amount of impermeable surface as much as possible, to improve stormwater infiltration and to make the microclimate onsite more comfortable. (Pavement heats up in the sun and produces an “urban heat island effect” which warms the microclimate onsite.) In places where pavement is required, the plan recommends that permeable pavers be used to maximize stormwater infiltration. In places where technical considerations require the use of asphalt or concrete, those areas can be designed to direct stormwater flows into adjacent permeable spaces, such as rain gardens. The goal is to infiltrate all of the stormwater that falls on this schoolyard onsite.

The plan includes long-lasting natural materials as a key component of the ecological design. This includes robust, native shrubs to create sustainable, low maintenance green landscapes. Overall, the plan seeks to create a perceptibly pleasant and balanced, relaxing atmosphere.

### DESIGN CONCEPT

The design concept seeks to create an attractive, living school ground environment. This includes a varied spatial arrangement, which balances the needs of the community, students, faculty, and the underlying needs of a functional infrastructure.

To save money, existing pavement in the North Yard and in the South Yard will be maintained, and only damaged pavement will be replaced. The necessary fire lanes are integrated into both yards as the widest, primary pathway in each space.

The plan includes natural materials for the majority of the ground surfaces and for edging in and around the play spaces. This includes wood chips and sand in the play structure fall zones, and planting borders made from hardwood logs, natural stone, boards, and boulders. The plan also includes low walls made from repurposed bricks and natural stone to enclose play areas and the green mounds. These will also be used by children for balancing and as seat walls. The design

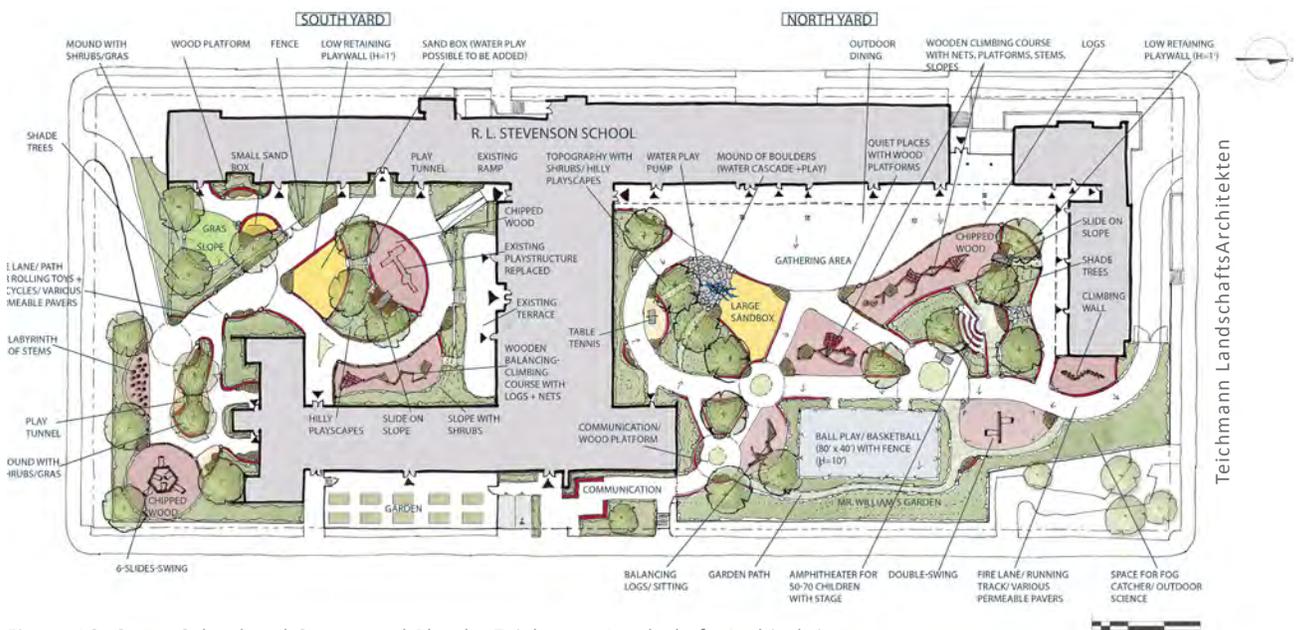
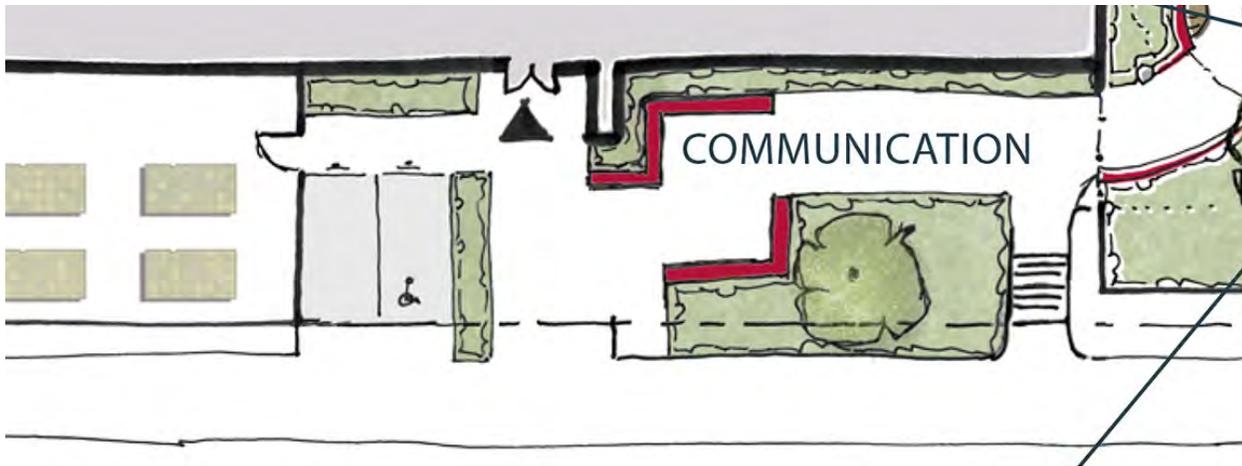


Figure 16: Green Schoolyard Conceptual Plan by Teichmann LandschaftsArchitekten



Teichmann LandschaftsArchitekten

Figure 17: Plan Detail: Front Entry, Stevenson School, Teichmann LandschaftsArkitekten

includes a variety of low wooden platforms made from hardwood and set at seat height, to encourage children to gather in small groups in different parts of the yard for learning and play. All play elements will be made from robust, long-lasting materials, such as hardwood from black locust trees (*Robinia pseudoacacia*).

The surface of the spaces intended for physical education classes are asphalt, suitable for all types of weather and a variety of potential uses. The pathway surfaces will be made from permeable pavers of many different types, to add to the variety of the ground surface textures, and to strengthen and enrich the movement experience for students. The new deciduous trees in the plan will create seasonal shade and help to organize and provide visual and physical structure for the space.

#### MAIN ENTRANCE

The main entrance to the school is located on the east side. The existing, straight pathway to the entrance and the two existing parking spaces will be maintained. The plan includes a new seating area made from low walls, near the front entrance to complement the drop-off/pick-up zone and create a welcoming entry area. The planting beds along the edges of this space will also be further enriched with additional blooming shrubs.

The access to the North Yard, with a gate and fence, will provide access for students and the school community at the beginning and end of each day. Similarly, the

fence and gate to the Education Outside garden will also be kept in its current configuration.

#### NORTH YARD

The North Yard is primarily used by older students. The design creates a nature play environment and scenery that is meant to be enjoyed by children during hands-on learning and play, and by the whole school community who will benefit from views of nature seen from the surrounding windows and from the paths throughout the space. The topography will create a strong visual impression from the gathering area and gradually moves into the school ground, along the structured, planted hills. The fire lane pathway is designed to be a running track and will be useful as a maintenance path during schoolyard workdays.

A wide pathway connects the main entrance on 34th Avenue with the spacious semicircular gathering area. This meeting place provides access to the classrooms with enough space for Morning Intake and also useful for school events. Major pathways are connected to the gathering space which lead into various play spaces around the yard, including the multi-functional ball game field. The middle of the North Yard will remain flat, to allow a direct view to the school building, and the new hills will be placed strategically around the perimeter.

The plan includes two wooden climbing courses with nets, platforms, and posts, placed above wood chip surfaces, in the middle of the yard. A sandy play pit offers the option for creative play with dry or wet sand.

The design also includes a water play landscape created using a playground water pump and rough natural stones and boulders arranged to form a play-oriented, attractive rocky landscape. When the weather is cooler, this space can be used without water, as a natural stone-climbing environment. The planted hill, which is located behind the rocky landscape, provides bushes that enhance children's imaginative play by becoming a backdrop for their creative adventures, and play props in games they create themselves. Behind the hill, small seating niches with wooden seating platforms are designed as an inviting quiet retreat. The plan also includes an outdoor

table tennis area and can also be adapted for games with larger balls, similar to four square.

Another hill is located on the northern side of the North Yard, and allows a slide to be integrated into the slope. The hill also includes an amphitheater outdoor classroom for 50–70 children, built with natural stone seats and steps, and a wooden stage. A nearby climbing wall adds additional play value.

The multi-functional ball game field is positioned on the east side of the North Yard. It is designed with an asphalt

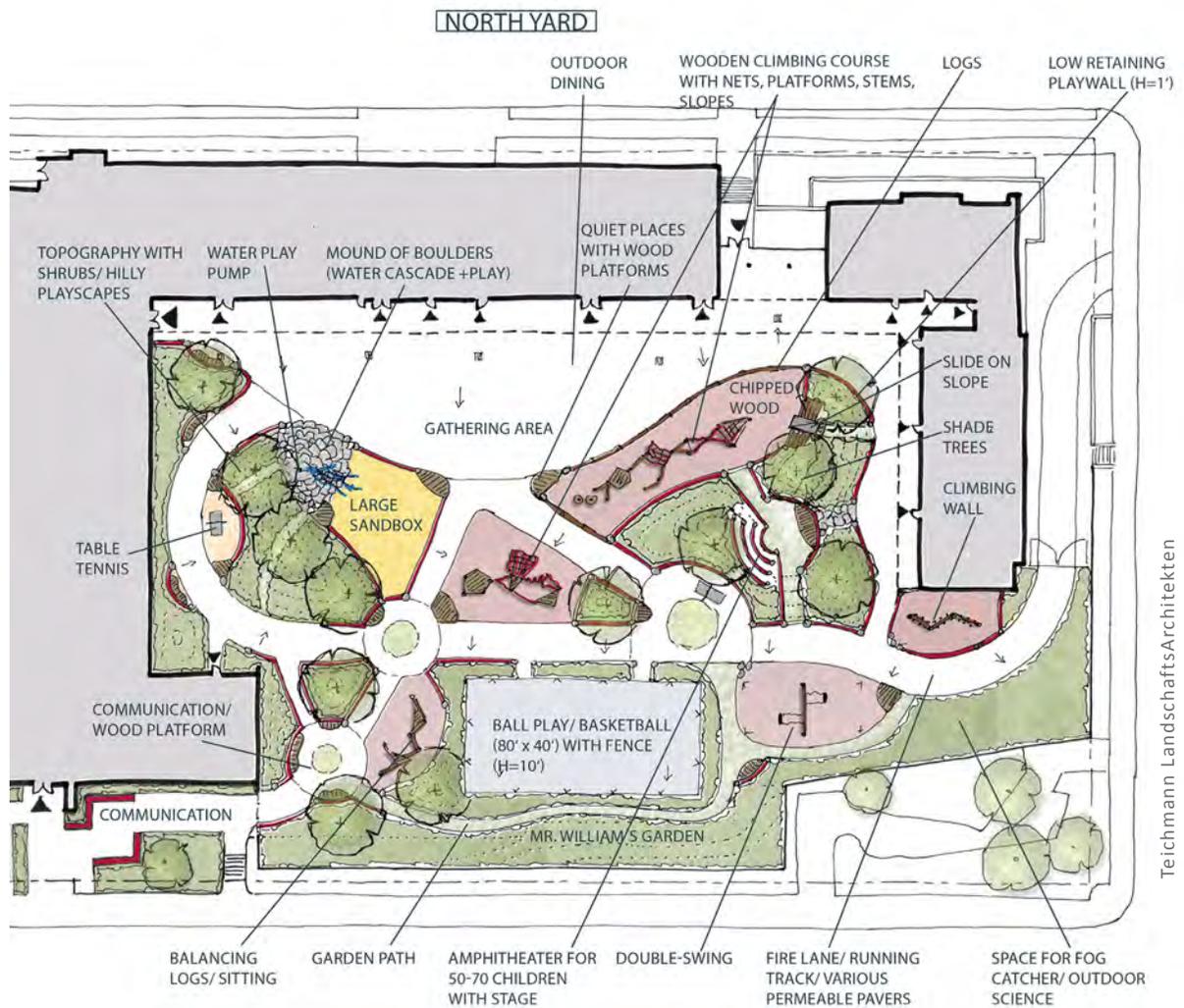


Figure 18: Plan Detail: North Yard, Stevenson School, Teichmann LandschaftsArchitekten

surface that can be used for a wide variety of ball games, and can also be used for rolling and skating activities. A 10' high fence, with two access points, encloses the ball game area and keeps balls away from the other areas. This protects children's active and imaginative play activities, and the nearby garden, in the adjacent spaces. The tall fence will be made from a material, such as chain link, that will not block views or sunlight. Shrubs are arranged around the ball game field to nestle it into the school ground without blocking views of the children inside. The plan also includes a double swing, and balancing posts with wooden seating platforms, in order to round out the physical play activities and age appropriate challenges that are included onsite.

In this plan, Mr. William's Garden is preserved in its current location to recognize the longstanding engagement with this garden and its importance to the school. Since a tall fence surrounds the ball area, this garden will be undisturbed by nearby ball games. A fog catching system for outdoor science activities and irrigation use will be added to the northeast corner of this year, along the existing school ground wall. Twelve trees are also planned in the yard to help organize the space and provide shade.

#### SOUTH YARD

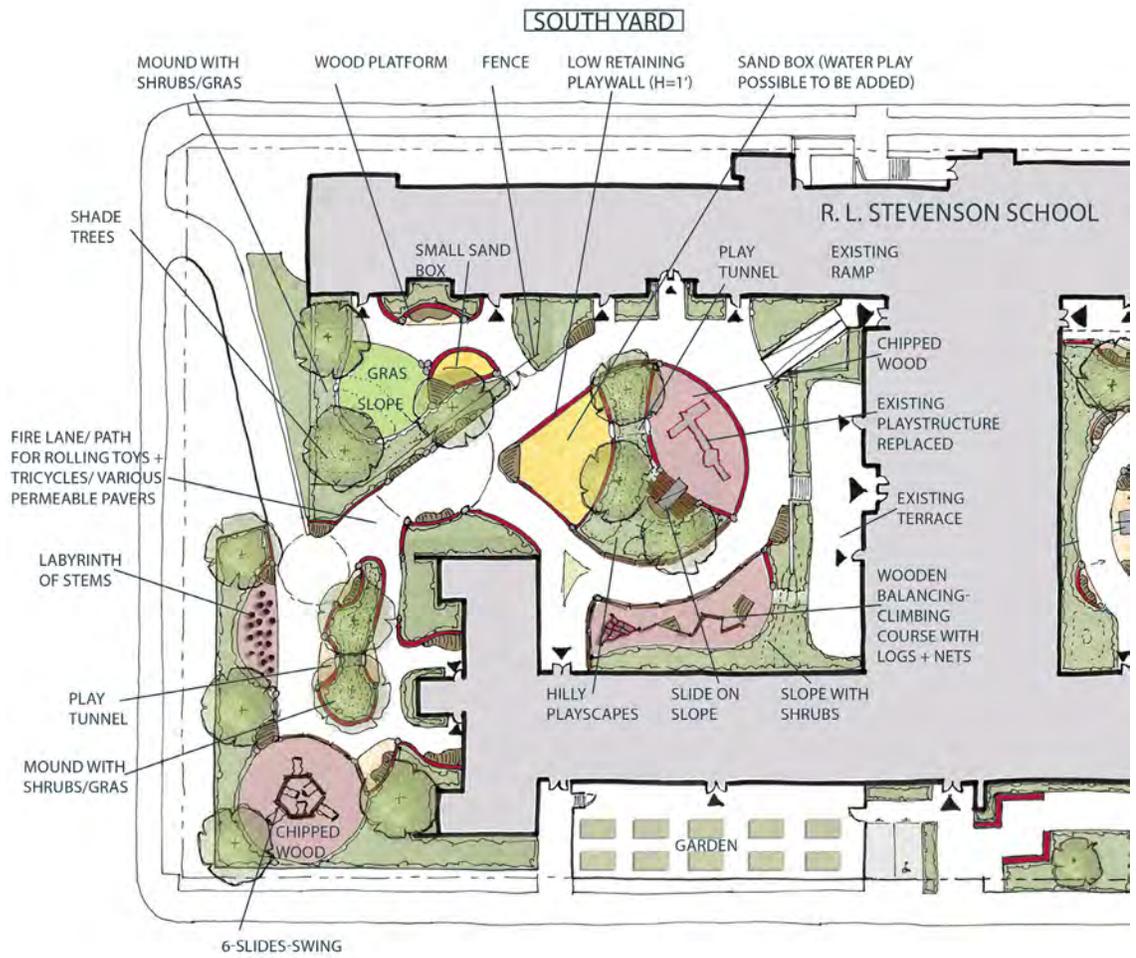
The South Yard is mainly used by younger students. Like the design for the North Yard, it is also structured as a nature play environment with hills, and 11 new trees that help to organize the space and provide shade. The natural scenery is meant to be enjoyed by children in a hands-on manner, and by the whole school community as who will benefit from views of nature from within the site and from nearby windows. The required fire lane is maintained and can be paved with a wide variety of permeable pavers, or by using the existing asphalt, as desired. The fire lane is integrated into the overall pathway system and can also be used as a running track and/or pathway for tricycles or other rolling toys.

The existing raised terrace and the access ramp on the north side of the South Yard will be maintained. Only one small part of the terrace will be removed to build a

planted slope. The pathway in the slope leads directly to the new climbing area that now includes a wooden climbing course.

The middle island, at the center of the pathway system, is divided by a planted hill with play space on both sides. One side of this hill includes the existing climbing structure, moved to this new location. The other side of the hill includes a generous sand pit, framed with low seating walls. The sand area is large enough for a whole class of students to be able to engage in collaborative sand play, at the same time. This substantial sand pit also plays a key role as an infiltration area for the stormwater runoff from nearby paved surfaces. There is also an additional space for kindergarten students and special needs students, separated with a low fence. This space offers developmentally appropriate, physically challenging play with a grassy slope, a small sandbox, and seating areas with wooden platforms.

The southeast portion of the South Yard includes a 6-sided "social swing set" on a wood chip surface. This structure allows six children to socialize as they swing together. A "nest swing" could also provide similar play opportunities, if a 6-sided swing is unavailable. A planted hill in the center of this part of the schoolyard includes a play tunnel, as well as play opportunities on top of the hill. A labyrinth made of wooden posts completes the play and movement offerings for this part of the yard. The plan also includes wooden seating platforms next to the classroom doors to promote quieter play and outdoor learning near the classroom entrances.



Teichmann LandschaftsArchitekten

Figure 19: Plan Detail: South Yard, Stevenson School, Teichmann LandschaftsArkitekten

EXAMPLES FROM BERLIN, GERMANY



Sand box



Various permeable pavers

Teichmann LandschaftsArchitekten



Hilly Playscapes



Wood platforms



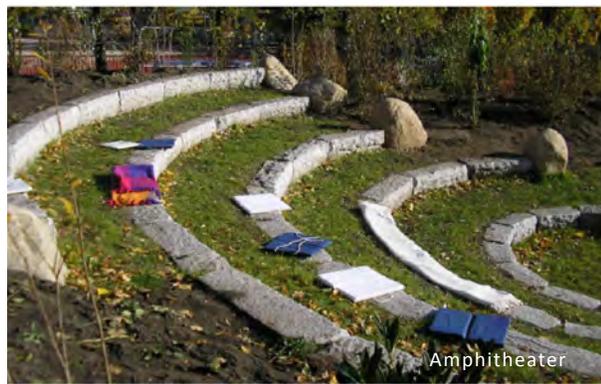
Mound with shrubs



Climbing wall



Water play pump on mound of boulders



Amphitheater



Six-sided swing



Path for tricycles



Low retaining wall



Climbing course



Hillside slide



Play tunnel



Balancing logs

## ADDITIONAL DESIGN AND PLANNING

### SCHEMATIC DESIGN PROCESS

At the end of the design workshop in January 2017, participants at the charette asked if the planned design process could be modified to include children’s input as well as the adult ideas that had been gathered to date. As a result, Miller Company held an additional workshop with a small group of students to solicit their ideas for the schoolyard design. Green Schoolyards America also prepared a “Favorite Places Mapping” exercise for children that the Education Outside teacher, Sarah Minkin, implemented with her classes, to further understand students’ perspectives.

In March 2017, Teichmann LandschaftsArchitekten completed the Conceptual Plan previously described on page 16 and Appendix C, which summarized Teichmann’s recommendation for the site design at Stevenson School, and reflects the design style and comprehensive scope used by her firm for school grounds in Berlin, Germany.

In May 2017, Miller Company developed the Schematic Plan for the Stevenson School site (Appendix E) based on the participatory design process to date and elements of Teichmann’s design philosophy. The school community, the school district, and the Planning Team reviewed the plan and each provided feedback to Miller Company, which they used to update the schematic plan in October 2016 (Appendix F). The resulting schematic design took into account the site specific needs and desires of the school community and the current regulatory and approvals framework that is present in the San Francisco context. The Schematic Plan was also cost-constrained to the available project budget.

### PLANNING FOR THE FUTURE

The Team’s goals for this project were bold and ambitious. The ultimate goal is to develop a model that will help shift the norm from asphalt covered school grounds to an ecological, multi-use natural space with green infrastructure as stormwater management. Creating this vision is more complex than simply shifting the physical infrastructure. There are many aspects of the policy, regulatory, and funding frameworks that will need to change to take this paradigm to scale. Similarly, the social and educational systems that intersect with the physical changes to the site also need to advance in order for growth to occur and the goals to be realized.

To expand the impact of Berlin-model schoolyards, Birgit Teichmann also led a Technical Training Workshop for design and engineering professionals on January 12, 2017. The workshop showcased her firm’s stormwater schoolyard design philosophy and the successful school grounds they have built across Berlin, Germany over the last two decades. Insights gained from this workshop are helpful to consider as the Planning Team reflects on lessons learned from the planning process for R. L. Stevenson School. They are also useful to determine the path forward toward the larger goals of shifting the norm for schoolyard design in the Bay Area. Appendix G includes a summary of best practices for stormwater schoolyard design that Birgit Teichmann presented during the Technical Training Workshop. Appendix H also summarizes the workshop audience’s reflections on what it will take to bring these ideas to scale in a California context.

The following section reflects on lessons learned from the innovate collaboration around R. L. Stevenson Elementary and how that work can support future progress toward stormwater schoolyard ideals.

## REFLECTIONS AND LESSONS LEARNED

R. L. Stevenson Elementary is the first large-scale collaborative green schoolyard project jointly undertaken by the SFPUC and SFUSD. It was successful in establishing a closer working relationship between the institutions and in pursuing multi-benefit outcomes that align with each organization's internal goals. Below are the major lessons learned throughout the planning and design process that will help inform future stormwater schoolyards in San Francisco.

### DESIGN COLLABORATION

For the project at R. L. Stevenson, SFUSD hired Miller Company as the local landscape architect and designer of record. After the project had kicked off, the SFPUC hired Birgit Teichmann to help inform the design at R. L. Stevenson and integrate best practices from Berlin's green schoolyards into the local design framework. While the teams were able to work together during Teichmann's visit, the scope of work did not allow for a full and seamless collaboration throughout the design process.

For future projects, the design collaboration and resulting design goals should be specified by the project partners at the beginning of the project. The team of designers should be selected together and jointly overseen by the project partners. In addition, significant time should be spent discussing and planning for this collaboration throughout the life of the project.

### PERFORMANCE METRICS

One way to improve design outcomes in future projects is to establish clear performance metrics from the beginning of a project. The project should set specific targets for education, children's health and wellbeing, stormwater management, and other environmental goals.

The City of Berlin's "Sponge School Ground Strategies" discussed by Teichmann (see Appendix G) call for integrating stormwater management goals with climate resilience planning. The Sponge School Ground approach reduces urban heat islands through air circulation, shade, increased reflectivity, and evaporation from trees, vegetation, and soil. It also

creates water sensitive school grounds by emphasizing infiltration, evapotranspiration, onsite stormwater reuse, as well as retention and detention stormwater best management practices.

The project at R. L. Stevenson set a stormwater management goal of managing one (1) acre of impervious surface on the school ground. While this traditional stormwater metric works well to estimate overall performance, it falls short on producing a design outcome that promotes integration of stormwater management and children's learning and play. In addition to acres managed or gallons of stormwater captured, a future project should specify goals around overall percentage of permeable surface on the playground, and percentages of tree canopy. These metrics support stormwater management goals while also incentivizing low-tech features that provide larger transformation in schoolyards.

For example, Berlin's schoolyards infiltrate 100% of the stormwater that falls on each site, accommodating a 10-year storm event. They do so through low-tech methods such as unpaving the entire site and shaping topography to hold the stormwater and allow it to infiltrate into the ground. These standards and low-tech methodologies allow for the City of Berlin to improve the outcomes for stormwater management and children's learning and play at the same time, and also ensures that the sites are easy to maintain for the public school system.

Educational performance metrics, such as hands-on outdoor education on the schoolyard, should be aligned with SFUSD's ecoliteracy goals, and set to match or exceed the modest recommendation in California's *Blueprint for Environmental Literacy*. The *Blueprint* recommends that all K-12 students spend at least 40 hours a year (roughly 1 hour per week of school) outside, engaged in hands-on academic activities across the curriculum in addition to time spent in physical education classes.

## PLANNING CONSIDERATIONS

The planning process for the stormwater schoolyard at R. L. Stevenson encountered some design and policy constraints that are important to note so that they will be addressed in future projects. Many of the topics that follow also came up in the discussions with the participants during the Technical Training Workshop on January 12, 2017, as noted in Appendix H. They include constraints that relate to policy, regulations, standard practices, timing, funding, maintenance, material restrictions, and other areas.

### ADA COMPLIANCE

Standards set by the Americans with Disabilities Act (ADA) in the United States establish a design baseline that is different from the context in Germany. In both places, site design and paths of travel are required to be accessible to individuals in wheelchairs, but they do so in different ways, using different materials. American laws are well intentioned, but their implementation makes it extremely difficult to provide code compliant access and permeable ground surfaces at the same time. It is particularly difficult to create code compliant, nature-based, park-like spaces on small plots of land since the required paved pathways often take over the



Figure 20: School grounds in Berlin use sand as the primary ground surface material under their play structures. Sand is one of the most effective materials for reducing playground injuries and provides high play value in its own right, particularly when combined with a hand-pumped water source.



Figure 21: This type of terracotta paver with internal gaps is commonly used in school grounds across Berlin, Germany.

available space. For example, ADA compliance makes it challenging to use the type of terracotta pavers with internal gaps (Figure 21, above), commonly used in school grounds in Berlin, Germany.

Playgrounds and schoolyards also encounter additional constraints from ADA regulations regarding fall zones for play structures. American landowners, including many school districts, often opt to use rubber and other non-permeable materials that are easy to maintain for wheelchair accessibility rather than use the loose sand and wood chips that are the standard in Berlin's schoolyards. Loose materials require frequent raking to stay within American safety and accessibility standards, and often school districts do not have the funding for this maintenance.

### MATERIALS

There are several landscape materials that are useful for stormwater schoolyard design that SFUSD currently does not use on school grounds. For example, the District does not currently allow schools to put in large expanses of sand for sand play or fall zones, as is the norm on Berlin's school grounds (shown, left). As mentioned, loose materials need regular maintenance, and they can also be tracked into the classroom on children's clothing if they are placed too close to doorways. Some schools in San Francisco also fear that cats will use sand areas as a litter box, and that hypodermic needles from drug users will be buried in the sandboxes. However, both San Francisco Recreation and Parks Department and Berlin's school system regularly use sand. Their management practices could potentially be used to inform future practices at San Francisco's schools.

### FIRE LANE ACCESS

All schools in San Francisco are required to have an approved fire lane. This fire lane must remain

unobstructed so that a fire truck and other emergency vehicles can access a school site in an emergency. The fire lane is typically added to the schoolyard site plan during the school’s initial modernization planning process, by the architecture firm that is overseeing building construction. This means that the fire lane is generally determined for each school site before the green schoolyard project begins and often greatly constrains the schoolyard design that follows. This lack of coordination in the planning timeline has caused many problems for green schoolyard design at San Francisco schools over the years, including this project at R. L. Stevenson. During the design process at Stevenson, the Planning and Design Teams wanted to move the fire lane, but were unable to do so due to schedule constraints.

To avoid this problem in the future, either begin the green schoolyard design at the same time as the initial modernization planning process to engage in a dialogue with the architects as they are drawing the underlying site plan—or allow the time and added expense to redesign and re-approve a new fire lane during the schoolyard design process.

#### PHYSICAL EDUCATION

The California Department of Education (CDE) does not have a firm requirement for the amount of land needed for each school ground, nor for the amount of space required for outdoor sports or games. It also does not require that particular paving or landscape materials be used in ground surfaces where physical education classes occur. Instead, CDE uses a “functional approach” in which each district must show how their physical education program can be provided on their school sites. These programmatic requirements can be met using both indoor and outdoor spaces.

Many districts have their own PE departments and some have arrangements with outside organizations that implement PE standards and follow spatial recommendations for sports and adult-led games. Green schoolyard projects frequently find themselves in conflict with these programs since the standard, fully paved urban school sites are 100% ball-friendly, and green schoolyard development (by definition) reduces the overall space allotted to ball games to balance it with other needs. In the future, the green schoolyard

design process should include time to discuss spatial needs with each school and strike a balance in the land use patterns between physical education, outdoor education, stormwater infiltration, and natural areas.

#### MAINTENANCE

Maintenance is a major challenge for San Francisco schools making a transition from pavement to a green schoolyard. Annual costs of landscape maintenance seem daunting to schools and districts that are used to budgeting only for capital investments and major periodic repairs. As a result, the universally paved schoolyard is considered the lowest cost option that is able to handle years of deferred maintenance.

However, new stormwater schoolyards can be designed following Berlin’s low-tech model to ensure that increased maintenance costs are kept to a minimum. Maintenance needs include simple tasks such as annual pruning of trees and shrubs and occasional replacement of elements made from natural materials. The maintenance burden can also be shared between the school community (PTA), student stewardship projects under the direction of a teacher, and through SFUSD’s site maintenance protocols.

The project at R. L. Stevenson also provides a unique opportunity to track the maintenance costs of a large-scale green schoolyard in detail and compare it to costs for SFUSD’s traditional (paved) school grounds. This data can be used to adapt stormwater schoolyard designs in the future to promote low-tech and low-maintenance technologies.

#### BUILDING MODERNIZATION COORDINATION

At R. L. Stevenson, the green schoolyard design and construction process followed the Prop A Bond modernization work on the school buildings—as it did with most of the other green schoolyards built with funds from Prop A Bonds passed in 2011 or earlier. This divided design process and delayed timing made it difficult to coordinate work on the buildings and grounds, reducing opportunities to find synergies and potential cost savings. Beginning with projects funded by the 2016 Prop A Bond, the green schoolyard and modernization work will be addressed at the same time. This will make it easier to coordinate the design for indoor and outdoor spaces. It may also lead to a reduction in unnecessary costs.

## FUNDING

This project has a substantial budget compared to other green schoolyard projects and is able to make infrastructure-scale changes, but the design is still significantly budget constrained. Since the available funding is not large enough to address the whole site, the school community had to make the difficult decision of whether to fully transform one half of the grounds, or to partially transform the whole site. The school chose to spread the funds between the two sides of the school grounds, so that children of all ages will have access to nature. This also means that neither of the schoolyards will truly immerse children in a park-like environment, as they do at schools in Berlin.

The project was also constrained by the types of funding sources available for the project. Due to Prop 218 requirements, funding from the SFPUC is required to have a direct nexus to the services the rates were collected for. This means SFPUC funding is only able to be used to fund the construction of stormwater related elements. Fortunately, SFUSD's green schoolyard funds are able to cover the costs of the outdoor learning and play elements the school requested. For future projects, additional funding sources should be leveraged in order to provide the flexibility required to support a well-integrated, multi-benefit project.

School grounds are one of our most heavily used public spaces—and yet their outdoor infrastructure typically receives much less investment than our park lands of similar size. Part of the work in expanding this field is to recast our school grounds as public infrastructure that needs investment on a much larger scale. Work needs to be done on measuring and quantifying all of the co-benefits of projects like stormwater schoolyards and bringing in additional benefits, like opening up the school grounds as public space. All of these benefits will serve as a strong base for additional funding to support these projects.

## STORMWATER FEES

San Francisco does not currently have a separate stormwater fee, like the City of Berlin, which provides an economic incentive to transform schoolyards. Berlin's annual stormwater fee is significant enough that schools find it economically worthwhile to unpave their grounds to avoid paying the fee. This fee structure is a useful

economic incentive for providing better site design for both stormwater management and children's wellbeing.

## CHILD DEVELOPMENT NEEDS

This project design was constrained in part by the school community's focus on maintaining existing supervision practices on the playground. Specifically, there was a concern from parents and teachers that children need to be completely visible at all times when they are outside. Physical education teachers also wanted to ensure that they had the space they desired for ball games, and asked to keep a large amount of asphalt for these games.

These concerns took precedence over current child development research that indicates that children are better served by having some time away from adults, in places that they feel they have some privacy (even if the adults can actually see them nestled in the vegetation). The green schoolyard approach follows this research and also seeks to engage child-directed active play as a substantial component of physical fitness, balancing ball game space with places for active child-led play in a challenging nature-based environment.

Shifting these aspects of a school's culture requires an investment of time and money to pay for professional development that brings in public health experts and other professionals to talk about current child development research and best practices. A future project should include funding for this type of professional development, to ensure the overall success of the project.

## ADULT AND CHILDREN'S PARTICIPATION

Green schoolyard design needs high quality participation from all segments of a school community to be most successful. This includes children's perspectives, as well as in-depth ideas from the principal, teachers, parents and other stakeholders. Future efforts should invest more heavily in participatory design, to further engage the school community and help them to feel a greater sense of "ownership" for the outcome.

Children's design time should be prioritized, so every child can be included in the design and visioning process for their future school ground. Input in the design process leads to stewardship of the finished site—and for children, to a lifelong understanding of how their actions can make a difference in the world.

## PROFESSIONAL DEVELOPMENT

The paradigm shift of transforming school grounds from asphalt-covered environments into park-like spaces needs to be accomplished with professional development for educators and the school administration. Professional development focused on outdoor teaching methods builds teachers' confidence in taking their curriculum outside, and makes them more likely to support the level of unpaving that is needed to create a green schoolyard with substantial stormwater management capacity.

The San Francisco Bay Area is fortunate to be the epicenter of school ground development in the United States. There are thousands of school gardens already built on school grounds across California, and hundreds of nonprofits working locally in related fields. This means that the professional development needs for this project, and future projects, can be met by allocating more funding to pay for the expertise that is already present in our local area. There are many organizations that can support green schoolyard-related professional development for teachers, parents, principals, and others who work with schools.

For this project at Stevenson School, the school administrator was able to participate in Green Schoolyards America's Principals' Institute. Stevenson School's principal participated in a yearlong program in 2016, which preceded the design process at her school. SFPUC staff also participated in this Institute.

The Principals' Institute was an effective way to provide green schoolyard training for principals. However, it would have been even more powerful if it had also included teachers and other project partners to share the training and support the principal in leading the school community's culture toward the new paradigm.

Figure 22: Participants in Green Schoolyards America's Principals' Institute took part in professional development to expand their understanding of green schoolyard design and use. The program included lively presentations and discussions (right top, with visiting expert, Prof. David Sobel) and tours of fellow participants' school grounds (right bottom).

## CURRICULUM

In the last few years, the State of California adopted a new *Blueprint for Environmental Literacy* that is slowly reshaping environmental education across the state. At the same time, California's science and history social science standards are also shifting to recommend outdoor teaching approaches that include Environmental Principles and Concepts.

These exciting new advances within the education field, supported by the California Department of Education, encourage schools to bring their students outside to a much greater degree for hands-on learning—with emphasis on using school grounds as a teaching tool. The statewide curricula and related initiatives present opportunities to dovetail the physical environment at each school with the curricula that the state would like teachers to teach. This is a strong leverage point for future projects seeking to shift the physical environment and build green infrastructure on school grounds.

In addition, there is an opportunity to incorporate curriculum directly related to the purpose and mission



of the funding agencies. The SFPUC could use future stormwater schoolyard projects to embed the SFPUC’s watershed stewardship curriculum and the SFPUC’s *Big Ideas* EcoLiteracy framework in local schools’ best practices. Stormwater schoolyards are also excellent locations for in-school, hands-on STEM inquiry.

## EVALUATION

The emerging field of green infrastructure development on school grounds in the United States needs additional data that document the multi-benefit outcomes of the investments made to shift the physical environment. In the Stevenson Stormwater Schoolyard project and future projects, it is extremely important to secure funding for measuring the impact of stormwater schoolyard investments. This will allow funding agencies to evaluate the effectiveness of the stormwater systems themselves, and also the effects of the whole project on children’s learning and health. Documenting these outcomes will help projects optimize current and future infrastructure investments, and documentation will position this work become a model for other schools and districts. Quantifying the costs and co-benefits will make it easier to shift the paradigm and move closer to the ideal in the future.

While we are not able to conduct a full evaluation of benefits at R. L. Stevenson, Green Schoolyards America has taken some initial steps to establish a baseline measurement of the microclimate at Stevenson School. They began by conducting an initial site assessment to measure school ground surface temperatures in Spring 2017, and hope to take additional measurements of playground surface temperatures in Spring 2018, before the new design is built, and to record surface temperatures in the same locations after the project is constructed.

In May 2017, Green Schoolyards America also collaborated with Stevenson School’s Education Outside teacher, Sarah Minkin, to pilot a temperature measurement protocol with 4th grade students. (Figure 23) They worked with two classes to measure the surface temperatures on the playground, and fine-tune a new standards-based climate curricula that Green Schoolyards America is developing with the Los Angeles Unified School District. When the curriculum is complete, they will offer the lesson and the accompanying measurement tools to the teachers at Stevenson School (and beyond)

so that they can engage their students in place-based scientific inquiries to assess their own environment. This lesson is intended to be part of an academic unit about climate change mitigation and urban heat islands.



Figure 23: Students at Stevenson Elementary piloted a new schoolyard microclimate curricula, developed by Green Schoolyards America. Two 4th grade classes participated in May 2017 during their Education Outside class and took baseline surface temperature measurements of the materials on their school grounds.

## **BIG PICTURE: HOW CAN WE SHIFT POLICY AND REGULATORY FRAMEWORKS TO SUPPORT MULTI-BENEFIT OUTCOMES?**

Green infrastructure projects on school grounds seek multi-benefit outcomes from a single set of investments on a given site. Since this is a relatively new approach in the United States, there are many aspects of the administrative, policy, regulatory, and funding frameworks that are not yet fully aligned to produce the desired result. Projects attempting to achieve multiple benefits currently meet with some friction as multiple goals come into conflict and vie for dominance. This slows down innovation and the speed of implementation. The reflections below consider some of the systems that need to shift in order for green infrastructure to thrive on school grounds.

### **ITERATIVE DESIGN-THINKING**

American policy, regulatory, and financial frameworks are set up to expect that every project will be perfect the first time it's built. In a new field, it is necessary to start with the assumption that some degree of iterative "design-thinking" will be necessary to fine-tune the approach during and after installation, to be able to achieve the desired level of performance that optimizes for multi-benefit outcomes. Cutting edge work takes some experimentation. If there isn't anything that needs adjustment, that means the design has not pushed the envelope very far. It is important to structure future projects to allow for design-thinking as part of the overall process.

### **POLICY CHANGE**

In addition to advances in education policy mentioned on the previous page, the State of California's other departments and agencies are working on efforts that dovetail with green schoolyard paradigms. There are upcoming changes being planned by the State Water Resources Control Board to the statewide MS4 permit that will encourage further unpaving of school grounds.

There is also a separate statewide initiative through the California Outdoor Engagement Coalition to unify state and local park planning efforts. School grounds may become a component of this park initiative, for their value to the community after hours.

The California state legislature also passed a resolution in 2014, which provides some leverage for the green

schoolyard field. ACR-128, the Living Schoolyard Month Resolution was authored by San Francisco's Assemblymember Phil Ting. It asks all schools to prioritize the design and construction of student accessible green space on school grounds, for academic instruction. The resolution passed unanimously, so we can point to strong support for this idea from our state's elected officials.

### **INTERAGENCY GOAL SETTING**

Most American regulatory agencies create codes and policies focused on a single outcome that resonates with their primary purpose. For example, school districts seek educational outcomes. Water agencies measure success in terms of stormwater management outcomes. Health departments look for mental and physical health benchmarks. To develop projects that are designed to achieve multiple benefits in all of these areas (and more), it is necessary to set holistic goals that account for these multiple benefits from the very beginning. This helps highlight the purpose and intent of each project partner and clearly communicate the benefits to each agency.

American regulatory frameworks and code compliance standards are often not conducive to this mindset and their decision-making and approval processes are generally not well integrated. Thinking and planning are "siloed" and happen without enough coordination between fields. Often, individual projects may need to go to multiple agencies or departments to get approval if they want to deviate from the accepted standard. In a school ground context with green infrastructure, this might include the Department of the State Architect, the school district, the water agency, the fire marshal, and others.

It would be beneficial in the future to create a new set of standards for green infrastructure design on school grounds, with multi-agency approval that takes each set of individual standards into account, and balances them at the outset, so that districts can more easily build green schoolyards in all of their schools.

### **FUNDING FRAMEWORK**

American financial planning systems are generally set up in a manner that strictly divides capital investments and maintenance costs. More attention is then paid to

the capital investment side of the equation. This division results in the perpetual lack of funding available for maintenance of public infrastructure, including green infrastructure and school grounds.

Stormwater schoolyards use trees, shrubs, and other plants as technical components. It is much harder to defer maintenance with these living systems (as opposed to asphalt or pipes) because their continued effectiveness depends on sustaining their health. It would be more effective to plan and manage green infrastructure on school grounds using an economic model based on life cycle costs that provides funding for ongoing site management to maintain the living systems that are integral to performance over time.

To make green infrastructure on school grounds the new norm, these projects will need additional funding for maintenance. School districts should look at maximizing funding from partner agencies by expanding the benefits and positive impacts from these projects to the public. For example, many districts have begun opening their green schoolyards to the community after hours and integrating them into city park initiatives using Joint Use agreements and other policy mechanisms. This type of ongoing partnership helps promote shared maintenance costs across all project partners that receive benefits.

## CLOSING THOUGHTS

This project at R. L. Stevenson will greatly improve the wellbeing of the children and the school community and it provides many insights that will be helpful for shaping future stormwater schoolyards in San Francisco and beyond.

Carving a new path is hard work and requires patience, persistence, creativity, and vision from the school community and each participating institution. This report concludes with an expression of gratitude for all of the participants' dedication that has moved the project forward to this point, and a sense of hope and inspiration for the collaborative work remaining on the road ahead.

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## APPENDIX A

### STEVENSON SCHOOL, SAN FRANCISCO - FRONT ENTRY AND GARDEN JANUARY 2017



Sharon Danks



**STEVENSON SCHOOL, SAN FRANCISCO - NORTH YARD**  
FALL 2016

Sharon Danks



# STEVENSON SCHOOL, SAN FRANCISCO - SOUTH YARD

FALL 2016



Sharon Danks



**STEVENSON SCHOOL, SAN FRANCISCO - SOUTHEAST YARD**  
FALL 2016

Sharon Danks



**STEVENS ON SCHOOL, SAN FRANCISCO - CORNER OF 34TH AVENUE AND PACHECO STREET**  
JULY 2015

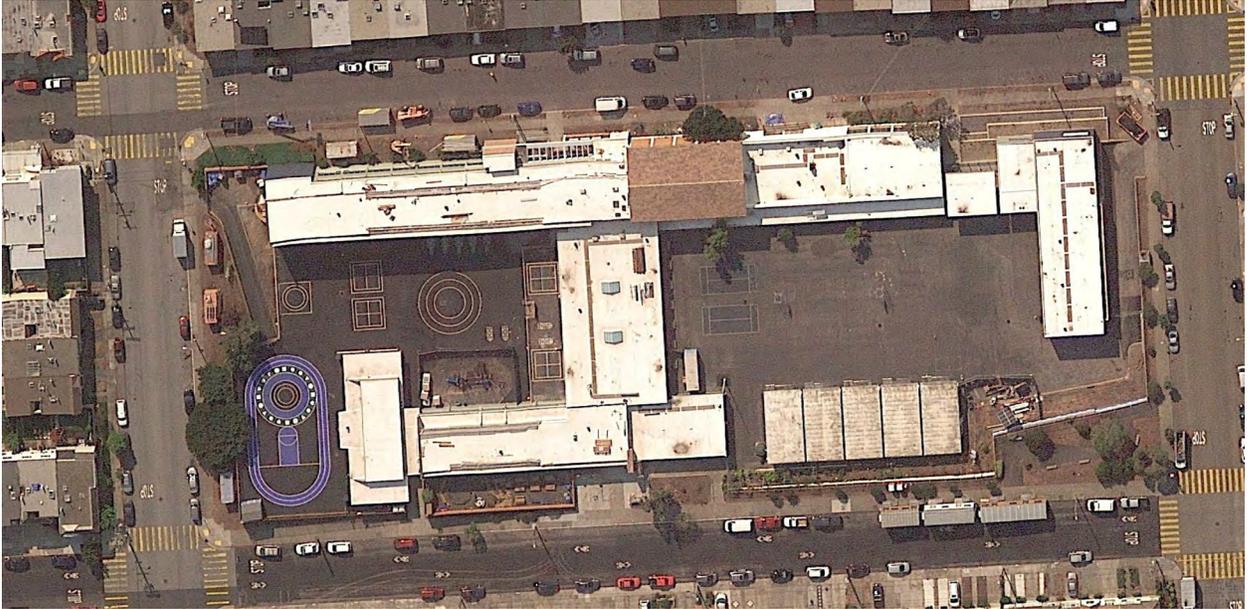
Google Earth, July 2015



## APPENDIX B

### STEVENSON SCHOOL, SAN FRANCISCO – AERIAL PHOTOGRAPH FROM GOOGLE EARTH DECEMBER 2017

Google Earth, December 2017



The image above shows the school grounds at R.L. Stevenson School in San Francisco after the modernization construction process added a new classroom building, but before any changes were made to the school grounds.

# APPENDIX C

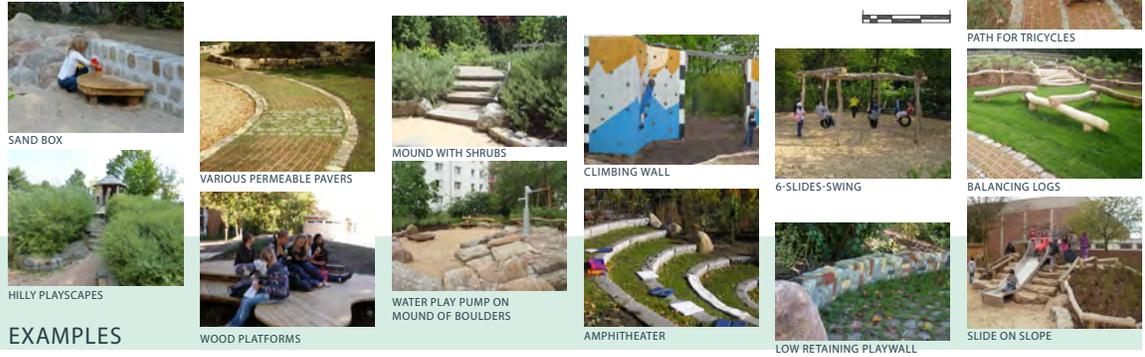
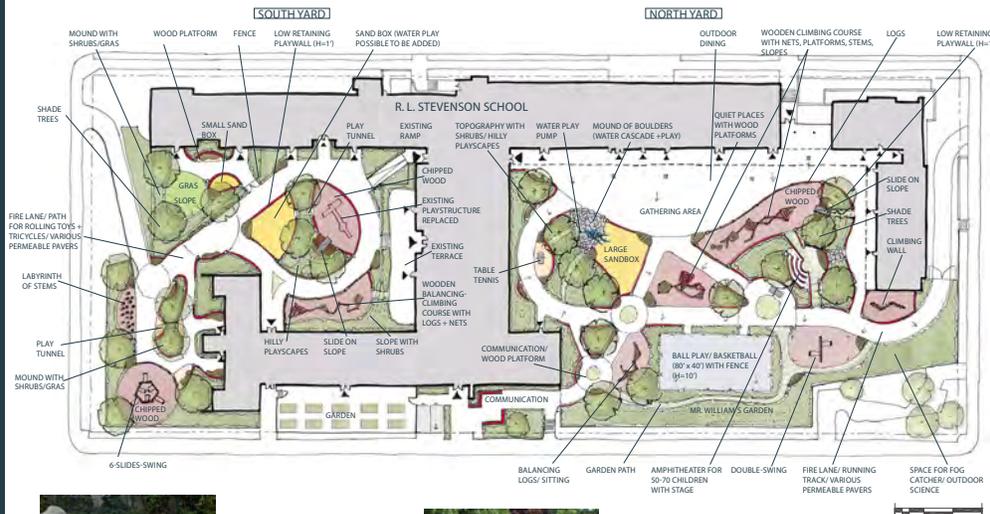
## STEVENSON SCHOOL, SAN FRANCISCO – STORMWATER SCHOOLYARD CONCEPT PLAN

TEICHMANN LANDSCHAFTSARCHITEKTEN

MARCH 2017

Teichmann LandschaftsArchitekten

### R. L. Stevenson School, San Francisco



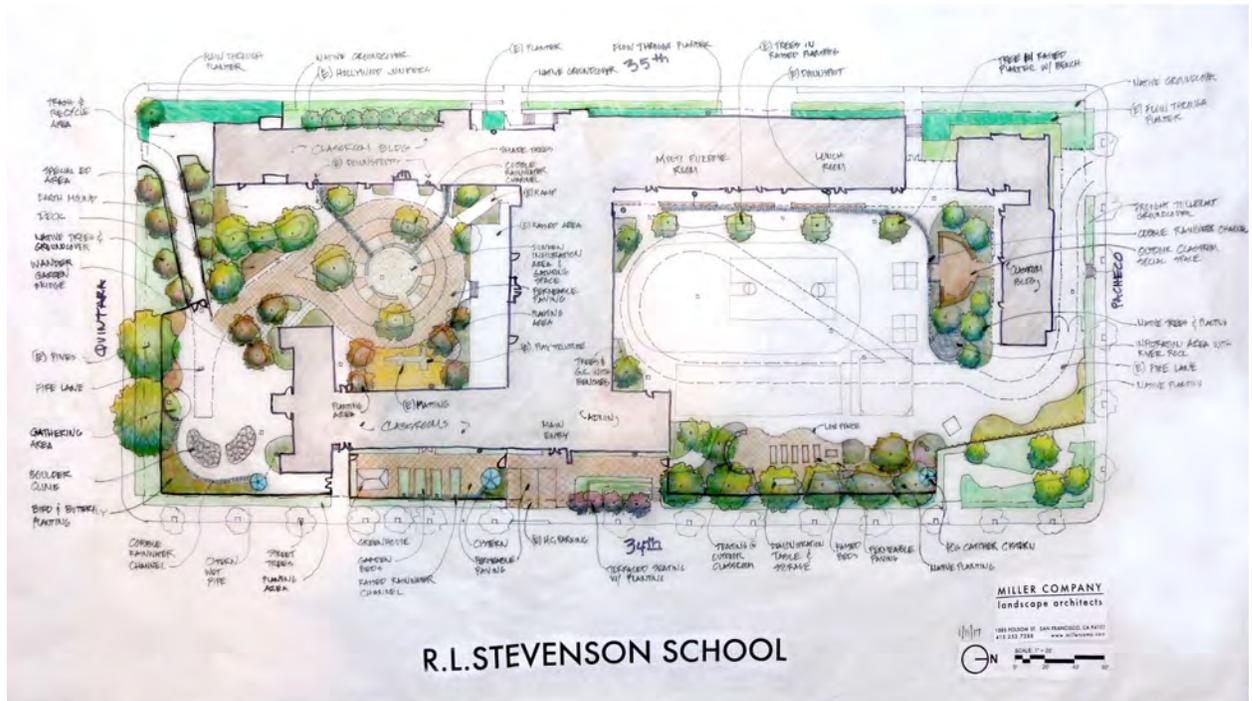
#### EXAMPLES

Birgit Teichmann GmbH LandschaftsArchitektur  
Columbiadamm 27, 10965 Berlin, Germany

## APPENDIX D

### STEVENS ON SCHOOL, SAN FRANCISCO – STORMWATER SCHOOLYARD CONCEPT PLAN MILLER COMPANY LANDSCAPE ARCHITECTS

JANUARY 2017

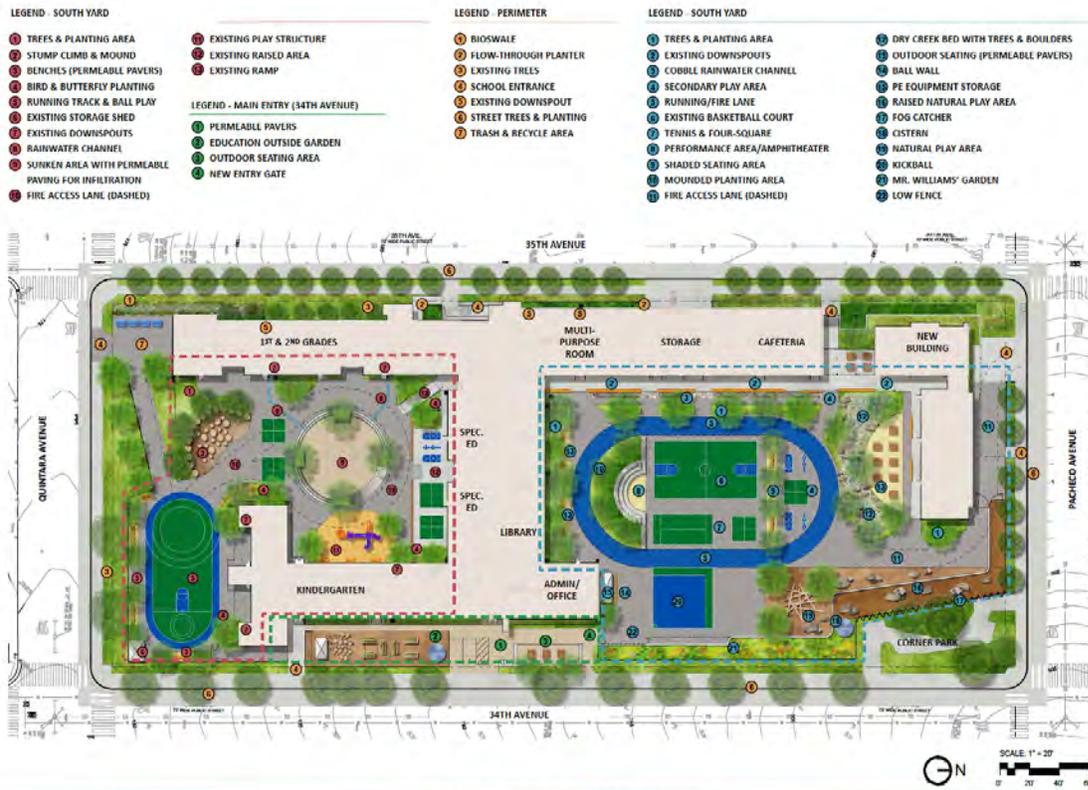


NOTE: This schoolyard concept plan created by Miller Company Landscape Architects was drawn prior to the team design charette, and was presented at the beginning of the workshop. It predates input from Birgit Teichmann.

# APPENDIX E

## STEVENS SCHOOL, SAN FRANCISCO – STORMWATER SCHOOLYARD SCHEMATIC PLAN MILLER COMPANY LANDSCAPE ARCHITECTS

APRIL 2017



**MILLER COMPANY**  
landscape architects

**ROBERT LOUIS STEVENSON SCHOOL**  
GREEN SCHOOL YARD & STORMWATER MANAGEMENT PROJECT  
APRIL 27, 2017

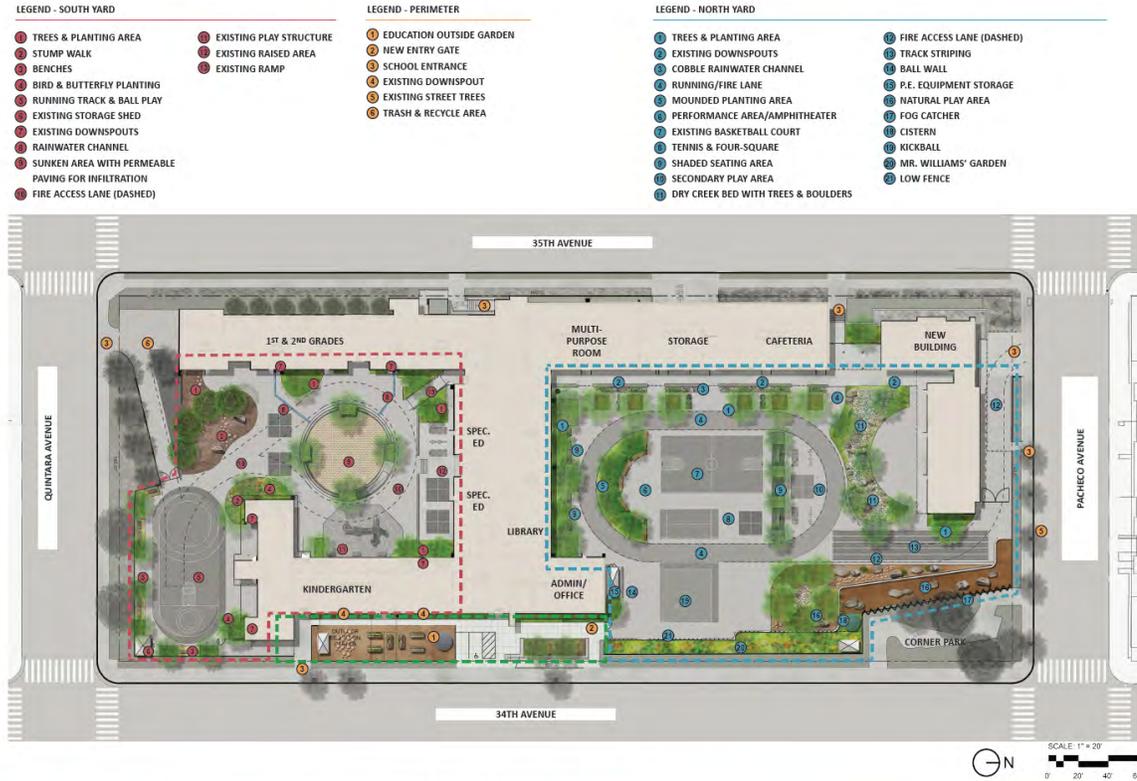
**REVISED LANDSCAPE PLAN V.3**  
SCALE: 1" = 20'

# APPENDIX F

## STEVENS ON SCHOOL, SAN FRANCISCO – STORMWATER SCHOOLYARD SCHEMATIC PLAN

MILLER COMPANY LANDSCAPE ARCHITECTS

OCTOBER 2017



**MILLER COMPANY**  
landscape architects

**ROBERT LOUIS STEVENSON SCHOOL**  
GREEN SCHOOL YARD & STORMWATER MANAGEMENT PROJECT  
OCTOBER 10, 2017

**PROPOSED FINAL SCHEMATIC**  
SCALE: 1" = 20'

## APPENDIX G

### BEST PRACTICES FOR STORMWATER SCHOOLYARDS: IDEAS PRESENTED BY BIRGIT TEICHMANN, TEICHMANN LANDSCHAFTSARCHITEKTEN

JANUARY 12, 2017

This document is a brief summary of best practices discussed by Birgit Teichmann during the two-part Technical Training Workshop held on January 12, 2017 at the San Francisco Public Utilities Commission. This summary was prepared by Sharon Danks (Green Schoolyards America) from Teichmann's full length presentation.

Full-length video recordings of this program can be found online at the following links:  
Part #1: <http://bit.ly/LSY-SI-video> and Part #2: <http://bit.ly/LSY-SI-video2>

#### DESIGN AND COMMUNITY ENGAGEMENT

##### PROJECT INITIATION

- Schools are the ones that initiate green schoolyard projects in Berlin. The school has to want a green schoolyard in order for the project to be successful.
- Public agencies and school districts play a supporting role in Berlin, providing the institutional framework and funding needed to bring the project to fruition. (Top down coordination and funding supports grassroots initiatives.)
- The state government for Berlin has a department called *Grün macht Schule* that specializes in helping schools create green schoolyards. Schools come to them for assistance, and they navigate the bureaucracy and help to match each school with the funding, advice, training, and specialty contractors/artists they need to create their green schoolyard.
- The citywide stormwater fee on impermeable surfaces, charged annually on all properties in Berlin, provides an important economic incentive for schools and school districts to unpave their grounds and keep them unpaved in the years to come.

##### DESIGN PHILOSOPHY

- Shape the landscape design to reflect the school and its community.
- Create school grounds that are comfortable, welcoming, park-like environments.

- Create site designs for school grounds that contribute to their city's ecological resilience in the face of climate change. Follow "Sponge School Ground" goals to manage stormwater and moderate temperature.
- Use the lowest level of technology possible to achieve the overall site design and all other goals. (e.g. unpave the whole school site and add topography, trees and shrubs, rather than relying on pumps)
- Plan to include some "chaos" in the design. Nature's aesthetic and children's aesthetic include more visual chaos than typical "clean" adult aesthetics. Focus on children's needs in environments built for children.
- Make the most of each site's potential. Save existing trees and large shrubs. Use existing topography if there are already some hills onsite.
- Maximize the number of different experiences children can have by including all different types of play elements, natural construction materials, outdoor rooms, and microclimates.

##### SITE PLANNING, DESIGN PROCESS AND IMPLEMENTATION

- *Path Analysis:* Teichmann LandschaftsArchitekten begins their school ground design process by designing the network of pathways. Pathway placement is determined by observing existing use patterns onsite and following the users' "desire lines" to see how people move most efficiently from one place to another. The firm maps the movement patterns they observe, discusses them with school

personnel, and then uses the information as the organizing framework for the overall site design.

- *Place-Making:* Next, the designers identify spaces between the pathways and nestle different types of uses into each one. Play areas are one of the first to be identified, and go into locations that are the most desirable for play, e.g. nestled in the shade of an established tree.
- *Topography:* After focal points have been identified, the designer considers the topography for each area, and adds mounds between the pathways. The topography is shaped to control stormwater drainage and create “outdoor rooms” for different activities. The amount of soil that is cut and filled onsite must be balanced so that no soil will need to be imported or exported to create the topography.
- *Vegetation:* The designer surrounds each outdoor room with a buffer of vegetation, and also adds vegetation buffers around the perimeter of the school site to screen the school from the neighborhood and streets. The plant pallets in Teichmann’s designs rely on robust native trees and shrubs. They do not use perennials since they do not stand up to heavy foot traffic from hundreds of children.
- *Master Plan:* The designers use the above adult-based site analysis as their framework, and then add ideas developed by children into this framework to create a master plan for the school grounds. (See additional notes below about participatory design.) The plan goes through several revisions as the school community reviews it. The final master plan is adopted when they have reached consensus.
- *Technical Plan:* A technical plan is prepared after the master plan is complete. It includes all of the details the builders will need to build the site according to the design. The more specific this information is, the better the outcome. (This type of plan is similar to schematic plans and construction drawings in the USA.)
- *Professional Construction:* The landscape architect oversees construction work implemented by professional contractors.
- *Community Building:* After the main site elements have been built, students work with local artists,

like stone masons, carpenters, and tile mosaic artists, to create and install substantial design elements that add character to the site and build a sense of “ownership” for the final product.

#### CHILDREN’S PARTICIPATION IN DESIGN AND STEWARDSHIP

- Children’s roles in the design, planning, building and stewardship of a green schoolyard are central. Their participation is *not* an added component—but is of *central importance* for creating a green schoolyard. Their ideas are pivotal and strongly influence the overall framework that is created for the site.
- The landscape architect should hold workshops that involve all of the children at the school in the design process. Workshops can include model building and other ways to visualize site design options.
- Use the design process to help children practice communication skills and consensus building techniques.
- Engage parents and teachers in contributing design ideas for the site, too.
- Bring in local artists to work with students after the main construction is complete, to create and install temporary and permanent artwork made from natural materials. Children are capable. Train them in real art techniques and then trust in their skills to do complex projects such as carving wood and stone under the direction of local experts and artists.
- Include children in ongoing site improvements such as modifying paving to add additional texture and patterns to the ground surface. Use simple, low-tech construction techniques that children can build and repair themselves if needed.
- Include children in the stewardship of the completed green schoolyard. Their role is to learn how to be good stewards of the land they share, and the maintenance they perform is a nice benefit, but it is not the main outcome. (Students assist with maintenance, but are not the main maintenance crew in Berlin. Maintenance is the responsibility of a school district/city government facilities/public works department.)

## ENVIRONMENTAL CONSIDERATIONS

### SPONGE SCHOOL GROUND STRATEGIES

- Follow “Sponge School Ground Strategies” to contribute to the city’s ecological resilience in the face of climate change, by managing stormwater and moderating temperature.
- Reduce urban heat islands through ventilation, shade, increased reflection, and cooling through evaporation from trees, vegetation and soil.
- Create water sensitive school grounds by emphasizing infiltration, evaporation, onsite storage, retention, and drainage.

### STORMWATER MANAGEMENT

- *Aim to infiltrate 100% of the rain that falls on each site.* Design for the 10-year storm event.
- Unpave as much of the site as possible and remove concrete and asphalt. (Save concrete pieces for use in building topography.)
- Use permeable pavers for pathways, gathering spaces, and other areas where paving is needed.
- Use permeable natural materials for play structure fall zones.
- Remove all storm drains that flow into the municipal stormwater network.
- Direct roof water from school buildings into vegetated areas to infiltrate into the ground. If flows are high, use underground detention basins to give the water more time to percolate.
- Use living roofs and “blue/green roofs” to slow the stormwater’s passage from rooftop to landscape.
- Shape the topography onsite to channel stormwater to places where it can most easily infiltrate. Reinforce channels with expected higher flows, e.g. detention basin outflow areas.
- Make stormwater flows visible so that children will understand the schoolyard watershed.
- After infiltrating stormwater into the site, drill a groundwater well to irrigate the vegetation onsite

if supplemental water is needed during plant establishment and unusually dry weather.

### CLIMATE CHANGE MITIGATION

- Remove as much paving onsite as possible to reduce thermal mass that absorbs the sun’s rays.
- Shade as much of the grounds with trees as possible.
- Use evaporative cooling from the trees, plantings and soil to cool the school ground microclimate.
- Be sure to maintain spaces between school buildings and other structures to allow air circulation that will further cool the grounds and provide fresh air.
- Add light colored surfaces to south facing building walls and other structures to increase reflection and reduce heat retention.
- Vegetated walls and roofs are also helpful to reduce temperatures.

### MATERIAL USE

- Use natural and recycled materials wherever possible. Save the building materials during demolition, and reuse them to create seat walls around planting mounds, and as fill material to create topography.
- Use loose sand and shredded wood to create soft play structure fall zones.
- Use long-lasting *Robinia spp.* wood for play structures. In Berlin, this type of wood will last 20 years if it is placed in the sun and 15 years if placed in the shade.
- Maximize the number of textures and types of natural materials used in pathways and other ground surfaces to add interest and challenge. Avoid smooth surfaces on the ground. They are not challenging or interesting and are detrimental to child development, since they hinder the development of coordination and balance.
- Use permeable pavers to reinforce high traffic areas such as pathways.

## CHILDREN'S WELLBEING, LEARNING AND PLAY

### PLAY

- Design the play areas to fit the site. Don't design the site to fit standard play structures. The needs of the children and the site should drive the design and use, not commercial ideas of play.
- Avoid commercially designed, standard catalogue play structures. Use unique play elements built from natural materials that also comply with local play standards.
- Include large sandboxes with hand-powered water pumps in every elementary and preschool yard.
- Include as much physical challenge as possible for every age group, including the oldest children at the school. Nature play has a much lower injury rate than standard playground equipment, according to a study by Berlin's insurance company. These findings are also confirmed by other research around the world. [See references to research on this topic from many countries in a document created by the International School Grounds Alliance: *Risk in Play and Learning*, <http://bit.ly/ISGA-RiskDec> Teichmann and Danks both participated in writing this document, with their colleagues.]
- Provide all different types of things for children to do as they grow and mature each year, and that appeal to children with different interests (sports, nature, imaginative play opportunities, etc.).
- All elements should meet local safety standards and codes, and be inspected regularly.
- Surface flows of stormwater can be used for children's play if the water is not stored, and if it comes from places (like rooftops) with appropriate materials that will maintain good water quality. (e.g. Do not allow children to play in stormwater that has flowed off of copper rooftops or other unsuitable surfaces.)

### EDUCATION

- A high quality green schoolyard should provide educational opportunities for learning across the curriculum, at every grade level in the school.
- School grounds should provide opportunities for academic learning outdoors, both teacher led and child discovered. Learning opportunities should include basic mathematical experiences (counting, etc.) and opportunities to learn about natural sciences and hand-based technology.
- Include educational objectives that relate to physical abilities as well as academic standards. It's important to have goals for physical body movement and health (coordination, balance, strength, etc.).
- Include educational objectives regarding interpersonal and communication skills, as well as visual arts and music curricula.
- Green schoolyards should include gathering places of all sizes, so classes can meet outdoors in large and small groups, and children will have social environments at recess and after school in which to gather. Gathering spaces help children to practice their social and communication skills.
- Keep electronic devices out of the schoolyard environment, if possible. Students get plenty of access to them in the classroom. When outdoors with a class, rely on hands-on, experiential learning using the environment as the main teaching tool. Be sure that children get their hands dirty.

## INSTITUTIONAL FRAMEWORKS, SITE MANAGEMENT AND TRAINING

### FUNDING

- Work with local agencies to strategize about funding sources to achieve a desired green schoolyard goal.
- Create a governmental entity that can act as a coordinator to help schools navigate the funding system and match their goals with available funding sources.

### POLICY FRAMEWORK

- Integrate stormwater infrastructure planning with schoolyard site design to benefit children and the environment at the same time.
- Set up a stormwater management fee for the City that ties the amount of impermeable ground surface to the size of the fee. Set the fees on impermeable ground surfaces high enough that it is worth the time and energy needed to fix the problem. Incentivize property owners of all types to unpave their land and also create living roofs.
- Create and follow green schoolyard design guidelines and standards, recognized by the government.
- Prioritize green schoolyard infrastructure investments for low-income areas to achieve equity goals.
- If multiple public agencies are involved in oversight, ensure they collaborate.
- Provide examples of model projects that have worked effectively. It's better if these are local.

### SITE MANAGEMENT

- Design the site to be as low-tech as possible. This will also make it low maintenance. If there are no pipes and no pumps onsite, there will be nothing complicated to maintain.
- Aim to design school grounds so that they will only have simple park-style maintenance needs. (e.g. tree trimming, occasional replacement of worn out structures)

### TRAINING

- Train landscape architects as stormwater engineers and give them training in child development so that they can design for children, adults, and the natural environment at the same time.

## APPENDIX H

### WHAT DOES IT TAKE TO BRING STORMWATER SCHOOLYARDS TO SCALE IN CALIFORNIA?

DISCUSSION SUMMARY FROM THE SFPUC TECHNICAL TRAINING WORKSHOP

JANUARY 12, 2017

This document is a summary of the small group discussion and brainstorming session held at the end of the Technical Training Workshop, following Birgit Teichmann's presentations about stormwater schoolyards in Berlin. The meeting organizers asked the assembled workshop audience to think about how the ideas that Teichmann presented from her experience in Berlin could be applied in our context in San Francisco and across California. The summary below, created by Sharon Danks (Green Schoolyards America), combines the individual and group responses from roughly 70 members of the audience, and is organized by theme.

The workshop audience included professionals from many fields including: landscape architecture, architecture, engineering, city planning, park management, education, and nonprofit management. It included staff from the San Francisco Public Utilities Commission, San Francisco Public Works Department, San Francisco Unified School District, and other organizations and institutions.

This summary holds key insights that will be helpful in considering future plans to accelerate the adoption of stormwater schoolyards in our city and state.

#### HOW CAN WE USE GREEN INFRASTRUCTURE ON SCHOOL GROUNDS TO IMPROVE CHILDREN'S DAILY EXPERIENCES AT SCHOOL?

##### FOCUS ON CHILDREN'S EDUCATION, HEALTH, AND DEVELOPMENT

- Make infrastructure visible and use the grounds as a teaching tool, so children will learn outside across the curriculum. Use experiential education to help children be more engaged and gain more knowledge.
- Use green infrastructure to replace sterile asphalt landscapes and create richer experiences at school that stimulate children's imaginations.
- Integrate STEM/STEAM education, edible gardens, and watershed education.
- Meet public health goals for mental and physical health using the improved, greener school ground environment.

##### BUILD COMMUNITY AND ACHIEVE EQUITY

- Use schoolyard greening to help achieve equity for students who don't have access to nature.
- Use green schoolyards to add beauty and art to neighborhoods.

##### ENHANCE LOCAL ENVIRONMENTAL SYSTEMS

- Use green infrastructure to seek multi-benefit outcomes. Create wildlife habitat, "children's habitat", and stormwater management at the same time. Improve biodiversity.
- Use green infrastructure on school grounds to create more comfortable microclimates at school, and help to cool the nearby school buildings and neighborhood.
- Use lush plantings to increase oxygen in the schoolyard environments.
- Involve students in stewardship at their schools. Encourage them to participate in operations and management with school credit.

## WHAT DO WE NEED TO SCALE UP TO CREATE GREEN INFRASTRUCTURE ON ALL SCHOOL GROUNDS?

### FUNDING

- We need more funding, overall, to bring this work to scale. That includes more capital investments and more money for life cycle costs for ongoing management.
- We need large grants and/or bonds, and should seek to establish major new economic incentives to facilitate wide spread adoption of green infrastructure on school grounds.
- Funding sources should be shared and distributed equitably.

### SUCCESSFUL LOCAL EXAMPLES

- We need to develop successful pilot projects locally that we can refer to and use as examples for moving forward.

### POLICY AND/OR STANDARDS CHANGE

- ADA standards are well intentioned but poorly written to allow green schoolyards to be developed here, as they are in Berlin. We need to reconcile ADA codes with green infrastructure design and design for children's nature play, so that we can achieve accessible environments that also provide challenge for children and green infrastructure functionality.
- Perceptions about risk and liability need to be addressed with school communities, school district insurers, and play policy coordinators at each school/district to allow children to engage in appropriate and beneficial risk.

### PROFESSIONAL DEVELOPMENT FOR EDUCATORS

- Provide professional development for educators to help convey children's need for physical play and expand play policies to allow beneficial risk.
- Provide teacher training and outreach to increase teachers' comfort and confidence in teaching outside. This will make stormwater schoolyards more successful.

### COMMUNITY OUTREACH AND EDUCATION

- Work on how to maintain large scale momentum for green schoolyards over time, since school communities shift each year. Seek to increase community motivation and buy-in from parents, and individuals and groups in the community.
- Provide training sessions for parents about child development needs and how to promote health through physical play. Aim to alleviate parents' safety concerns and help them to shift their parenting styles and culture around perceived "safety".

### DESIGN AND ENGINEERING ENGAGEMENT

- Create design guidelines that help designers and engineers get started with green schoolyards, and meet applicable codes. Keep the design guidelines flexible and open to interpretation by design and engineering professionals, so that each site will look different and to allow for varied physical conditions at each school.
- Engage and inspire creative designers and builders who are empowered to follow best practices.
- Engage in design advocacy to inspire the public.

### CHANGES TO FACILITIES MANAGEMENT PRACTICES AT THE DISTRICT LEVEL

- Make maintenance and facilities management a priority. Help school districts to see that what they do on their grounds matters to children and the environment.
- Create catalogues of structures, native plant palettes, and materials that all schools can use as a starting point.

### OUTDOOR CURRICULA

- Collect and develop standards-based curricula for use outdoors, and teach teachers how to teach what they are already teaching, outside.

## WHAT ARE THE BARRIERS AND HOW CAN WE OVERCOME THEM?

### BUREAUCRACY

- This paradigm shift needs a champion at a high level to help overcome challenges that stem from entrenched practices in existing institutions.

### CODES NOT SET UP TO SOLVE FOR MULTI-BENEFIT OUTCOMES

- Most of our regulatory agencies create codes focused on a single outcome. We need codes that help us to solve for multi-benefit outcomes in order to be successful at a large scale. This problem can be seen clearly in issues related to ADA compliance and stormwater management and contact standards

### ONGOING SITE MANAGEMENT

- Most school districts are not currently set up to provide park-level management for their school grounds. They need more staff and funding.

### SMALL PARCEL SIZE FOR EACH SCHOOLYARD

- Urban school grounds in San Francisco are often very space constrained, which makes it difficult to balance the needs of different activities onsite.

### LACK OF COST-BENEFIT DATA

- It would be helpful to have more cost-benefit data from successful pilot projects to make the case for more funding. Measure all pilot projects, moving forward, to track costs and all types of benefits.

### TRADITIONAL PROJECT STRUCTURE

- Most current funding is only for initial capital investments. Green schoolyards need additional operations and management funding to see them through beyond initial installation.

### CURRICULUM AND HEALTH

- Current curriculum is focused on indoor education. Develop, collect, and promote standards-based curricula that makes it an “educational necessity” to go outside. Lobby curriculum decision makers.
- Develop green infrastructure on school grounds to promote children’s mental and physical health.

### RISK-AVERSE CULTURE

- Work on public education and outreach to educators and parents to connect current child development research with children’s needs for challenging, physical play.

## HOW CAN WE ALIGN EXISTING EFFORTS TO ACHIEVE MORE?

### COLLABORATE ACROSS DIFFERENT FIELDS

- Invite colleagues from many different fields to collaborate to create green schoolyards. Include nonprofits working on urban agriculture, community leaders of all types, and other local institutions.

### PARTNER WITH NONPROFITS

- Align with Trust for Public Land and other nonprofit organizations doing work that is related to green schoolyard design and use.

### LEVERAGE COMMUNITY

- Leverage eco-lovers and other enthusiastic members of school communities.

### USE EQUITY AS A UNIFYING THEME

- Discuss how to distribute schoolyard greening equitably: Some schoolyards are large, others are small; some neighborhoods are green, others are completely paved.

### PAY FOR NEW PROJECTS USING MULTIPLE SOURCES OF FUNDING

- Combine climate, stormwater, art, and education funding to achieve multiple benefits for children and the environment on school grounds. Include and mix funding streams from local, state, and federal sources and foundation grants.
- Look to use and align existing governmental sources of funding for school grounds. E.g. Proposition E funds in San Francisco, California’s Cap and Trade funds, etc.
- Use economic incentives to build new examples.

#### USE PUBLIC LAND MORE EFFECTIVELY

- Open school campuses after hours and on the weekend to expand community park space. Create more shared schoolyards.

### STANDARDS AND POLICIES

#### OPPORTUNITIES

##### EDUCATION FOR CHILDREN AND YOUTH

- Connect the curriculum and state standards to hands-on learning outdoors at school. Include stormwater education and horticulture/nutrition education.

##### EDUCATION FOR THE PUBLIC AND DECISION MAKERS

- Increase public outreach and education about the need for policies that support green schoolyards. Publicize pilot projects and models that have already been built successfully. Use them as a component of public education. Engage environmentally minded community members.
- Educate decision makers about the value of green infrastructure on school grounds.

#### DESIGN

- Create standard design guidelines for schoolyard greening. Include systemic ecological design that integrates hands-on learning and required regulations and design principles.
- Showcase case studies, demonstration programs and precedents.
- Structure design policies/practices to make green infrastructure visible and educational/interactive.
- Harness landscape architecture education/training philosophy that focuses on working with the site to bring out the best aspects of each location. Preserve and direct site design for the best use.
- Use design standards to encourage design creativity
- Include the landscape architects from San Francisco Public Works Department as potential designers for San Francisco's green schoolyards.

#### STANDARDS AND CODE COMPLIANCE

- Consider how codes from many agencies could be created and interpreted to generate opportunities rather than constraints.
- SFPUC could use its standardized details and specifications to promote multi-benefit outcomes for green infrastructure on school grounds.
- Codes and standards that were mentioned as potential opportunities include: LEED, MWEL and school district policies.

#### LEVERAGE ENVIRONMENTAL PLANS AND POLICIES

- Connect green city planning projects and environmental policies to the network of green schoolyards. Engage policies at the city, county, and state levels.
- Some specific local and state environmental plans and policies were mentioned as opportunities, including: Better Roofs Plan, Green infrastructure requirements (MRP), Climate Action Plans, Urban greening plans, SFPUC Stormwater Management Ordinance. SFUSD's policies and plans created in its office of sustainability, green schoolyard department, and facilities department were also mentioned.

#### SPECIFIC STORMWATER POLICY IDEAS

- Create new stormwater initiatives to bolster green schoolyard development.
- Streamline the approval process for projects based on their scope and cost (like Berlin).
- Use stormwater fees to reduce runoff and stormwater impact with green infrastructure (like Berlin).
- Increase onsite infiltration requirements (like Berlin).

#### PROFESSIONAL INTEREST

- Leverage the growing interest in this field from program administrators.
- Study existing and future examples of green infrastructure on school grounds to generate a cost/benefit analysis that will help to engage wider buy in from facilities and maintenance departments.

- Use standards and policies to expand access to the public land on school grounds
- Design policies to encourage the community to use school grounds after hours, and increase the base of supporters for green schoolyards.
- Schools are land owners/managers. Encourage them to make decisions as such.

## CHALLENGES

### COMPLEXITY, STRICTNESS AND BUREAUCRACY OF EXISTING POLICY ENVIRONMENT

- There are a vast number of existing policies and procedures. It's very difficult even for professionals to stay current with all of the new legislation.
- Approvals processes are often lengthy and complicated in many institutions, and there is a large amount of paperwork and bureaucracy to wade through to get anything done. Approvals need to be streamlined.
- Single purpose regulations and funding, lack coherence and interrelationship
- Most regulations for permitting green infrastructure on school grounds are very strict and single purpose. It's hard to achieve multi-benefit outcomes when complying with single purpose regulations. Codes from different agencies are often contradictory or have competing goals. These rigid regulations and guidelines also often link compliance to funding.
- ADA requirements, codes, and compliance are one of the biggest barriers to developing high quality green infrastructure on green schoolyards in the United States. The codes, as written, make it difficult to design for everyone without reducing the experience for the majority. The codes for paths of travel are particularly problematic due to direct conflicts between the need to build topography and rough ground surfaces for green schoolyards, and a requirement for near-flat, smooth surfaces in the codes. It's also difficult to leave much of the land unpaved and permeable if paved pathways need to reach every element.
- Earthquake requirements, health codes, physical education guidelines, plumbing codes and ASTM codes were all mentioned as problematic for green schoolyards.

### SPECIFIC STORMWATER-RELATED CHALLENGES

- We do not yet have an incentivized stormwater fee, and need this to create an economic incentive for green infrastructure on school grounds. Model a future stormwater fee on Berlin.
- Specific water-related challenges that were mentioned include:
  - San Francisco's Plumbing Code does not allow direct discharge of roof water onto the ground.
  - Policies related to the use of creek water need to be more flexible.
  - If impervious land is touched in a project, it might trigger whole-site compliance?

### BARRIERS OF JURISDICTION

- School ground land is permitted by the state, but the city has permitting jurisdiction on the surrounding urban land. This makes it difficult to plan together. The Department of the State Architect is not yet on-board or involved.
- Time during the school day/school year (if not integrated into school's framework)
- The school needs to be on board with greening to find the time to engage their students in hands-on outdoor learning.

### RISK PERCEPTION AND LIABILITY CONCERN IN A RISK-AVERSE CULTURE

- Protective parents need education about the benefits of being outside, and how to understand what is a hazard vs. a risk.
- Some organizations have liability concerns about adventure play and outdoor education.

### SITE MANAGEMENT

- More education and training is needed for school districts' maintenance staff. The overall budget for maintenance is also an issue that hinders this training. Money is needed for site management and staffing.
- Teachers need to be shown new ways to supervise school grounds that have lush plantings and trees.

- Aesthetics are of concern to adults, who don't always understand children's aesthetic or nature's aesthetic.
- Sometimes school grounds are closed to the public due to problems related to homelessness, drugs, litter, etc. Need more money to increase staff time and find other solutions to these issues.
- Lack of city and state best management practices hinders green schoolyard development.

#### SITE CONDITIONS

- Physical conditions of many school sites in San Francisco are complex and difficult to work with. E.g. steep slopes, groundwater and soil conditions might not be ideal; serpentine soils, etc.
- There are sometimes physical and material barriers to accessing school grounds after hours.
- Need to allow sand on school grounds in San Francisco as a material to be used for play and stormwater.

#### TRAINING AND PROFESSIONAL DEVELOPMENT FOR A NEW PARADIGM

- The paradigm shift to this new type of school ground requires education/training on the benefits of green infrastructure/green schoolyards. We need to increase the knowledge base across the community, including a shift for teacher/adults' perspectives on the qualities that make a good schoolyard.
- Not all landscape architects have experience managing the type of interdisciplinary team that green schoolyards require. Not all landscape architects have designed with children as clients.
- Frequent changes in leadership, such as principals and agency staff, make training difficult. It needs to be ongoing to include new individuals.

#### DESIGN

- Need to overcome standardized design and achieve site-specific design that's best for kids, and creates a sense of place.
- Ensure that the design works for all different needs and diverse communities

#### EQUITY

- Equity is an issue in access to green schoolyards. We need to spread the resources for green infrastructure onto school grounds in an equitable way and prioritize low-income school communities.

#### PRIORITIZATION

- How can we make green infrastructure on school grounds a bigger priority for the public and decision makers? Some schools may just want to meet the requirements and don't see the opportunities for education. More public outreach is needed.

### FUNDING MECHANISMS

#### OPPORTUNITIES

#### GOVERNMENT AND PUBLIC AGENCY FUNDING SOURCES ARE AVAILABLE AT LOCAL AND STATE LEVELS.

##### *Local sources*

- Use local green infrastructure funding (from all sources) for schoolyards.
- School district: SFUSD greening grant/bond is a major local source of funds. Increase the amount per school if possible in the future.
- City bonds might be useful if school grounds/green infrastructure can be considered parks.
- SFPUC funding sources might include: Watershed Stewardship Grants, "Add Back" funding, Discharge/fine funding, as well as future stormwater fees based on each site's permeability (like Berlin), and perhaps mitigation banking funds?
- Other City departments, agencies and programs might include: San Francisco Planning Department's "Pavement to Parks" program; San Francisco's Board of Supervisors; San Francisco Department of Environment; San Francisco's Public Works Department; San Francisco Community Challenge Grants; San Francisco Parks Alliance; local taxes
- San Francisco's Proposition E, which provides tree maintenance funds that might be applied to school grounds?

### *California state level sources*

- Cap and Trade Funding – Greenhouse gas reduction funds and Urban Greening Grant Programs
- EPA funding?
- Proposition 84, CalFire grants, and other state funding sources

### CORPORATE SOURCES

- Corporate sponsorships and partnerships including ideas such as: horticultural sponsorships for gardens, donations from sports institutions and teams, and San Francisco Small Business Contracts

### FOUNDATION GRANTS AND DONATIONS FROM MEMBERS OF THE PUBLIC

- Grant sources may include: Foundations, community-based funding, PTA funding
- In-kind support: Stewardship contributed by the school community can save some money by offsetting some maintenance needs. Students can also participate in site stewardship.

### OTHER ECONOMIC TOOLS

- Rebates to schools that reach sustainability goals, to apply toward further greening.

### STRATEGIES

- Align goals and share costs across multiple agencies. Encourage budget sharing and collaboration with organizations that have similar goals, e.g. botanical and horticultural groups, education, watershed management.
- Create engaging concept designs and other visuals to increase the chances of securing funding.
- Emphasize life cycle costs rather than looking at capital investment costs and maintenance needs.
- Quantify multi-benefit outcomes. Illustrate long-term savings of smart planning and long-term benefits to education and the community.

### CHALLENGES

#### FINDING LIFE-CYCLE FUNDING

- Need more funding for site management throughout the life of the project. The lifespan of projects doesn't match the funding cycles available for them.

#### NOT ENOUGH FUNDING

- Proposition A Bond funding for green schoolyards in San Francisco is a good start, but \$150,000 per school is not enough to change the infrastructure of the site. Need more capital investment for each school.
- Grant funding sources are usually too small to make a difference to school ground infrastructure. Often, only part of a project can be implemented at a time, and future phases aren't built. Currently, there is not enough funding for all schools in the school district to create infrastructure-scale projects.

#### NEED MORE FUNDING FOR PROFESSIONAL DEVELOPMENT AND STAFF TIME

- We need more funding for green schoolyard educators, particularly at schools that don't have enough resources within their community to hire their own extra staff.

#### STRUCTURE OF THE FUNDING

- Mixing public and private funding sources is complicated. It is also complicated to arrange interagency funding. Schools don't usually have the staff time to manage administrative or funding complexity.
- PTA funds can be flexible or constrained. They are also different from school to school, which poses equity issues.

#### FUNDING SOURCES ARE NOT WELL PUBLICIZED

- More work needs to be done to centralize/publicize the sources of funding that school grounds can access. Access to the funding needs more coordination.

#### DATA AND COST-BENEFIT INFORMATION

- There is not enough clarity for funders that green infrastructure on school grounds is a cheaper and better solution. There are not enough pilot projects

that have been measured in detail yet to explain the ecological and learning benefits. This is needed to make the case for larger scale funding and implementation.

#### TIMING

- Funding timelines don't always match the needs of participatory design (which is time intensive).

#### DESIGN

- Custom, site-specific design work is more expensive than standardized details. Every school site is different. Green schoolyard design is based on the principle that every schoolyard should be different and reflect its place and school community, so site-specific design is a priority.

### COLLABORATIONS

#### OPPORTUNITIES

##### MULTI-DISCIPLINARY PARTNERSHIPS

- Many potential partners with shared goals also have skills, ideas and resources they can combine and find synergy in creating collaborative solutions. Teamwork between the school district, developers, engineers and landscape architects is important. Families and children should be centrally involved.
- Nonprofits in many fields can be of assistance. Some mentioned during the workshop include: Trust for Public Land, Friends of the Urban Forest, Audubon Society, Save the Bay, Education Outside, Green Schoolyards America
- City agency collaborations are important: SFPUC, Public Works, and Recreation and Parks can all partner with each other and SFUSD on this topic.

#### INFORMATION SHARING

- Share best management practice knowledge across disciplines and between schools.

#### EDUCATIONAL VALUE OF THE GROUNDS

- Create partnerships between schools and natural resource and water specialists to connect curricula to site-specific features on the grounds.

- Convene wider partnerships to bring the possibilities of greater public exposure/PR to get the word out about excellent models/pilot projects.

#### POTENTIAL TO ACHIEVE MULTI-BENEFIT OUTCOMES

- Multi-benefit outcomes are possible through a skillful redesign of a paved schoolyard. Collaboration generates more creative solutions. Consensus builds community.

#### INCREASED POTENTIAL FOR BETTER USE OF PUBLIC LAND

- It's important to see parks, streets, and schools as an interconnected network of public land. Include state property within city limits as part of this network of public land.
- Open up schoolyard access after hours and create community gardens and shared park spaces on school grounds.
- Tactical urbanism is a tool that can be activated to engage underutilized urban spaces (like school grounds), particularly in neighborhoods that lack open space.

#### SOME PARTNERSHIPS CAN HELP DESIGN, BUILD AND MAINTAIN SCHOOL GROUNDS

- Landscape architects can lead a multi-disciplinary partnership during the design process, and coordinate the needs and desires of educators, students, families, neighborhood groups, artists, engineers, architects, city government, public agencies, etc.
- Involve students of all ages in all phases of the design and building process. Ensure that all schools are designed with a process that focuses on real, open-ended participation from children. Increase the feeling of "ownership" by inviting classes to take part in the initial installation and ongoing care of the site.
- Partner with community organizations and parents to maintain the grounds when school is not in session. Engage environmental clubs as schoolyard stewards.
- Experienced public space/playground designers might not know about nature play, so collaboration can help to extend their knowledge base.

- Experienced green infrastructure designers might not know about child development needs, so collaboration is helpful.

#### FUNDING

- Collaborations often mean that collaborating groups have access to a wider range of potential funding sources.

#### CHALLENGES

##### COMMUNICATION BETWEEN DISCIPLINES

- Getting designers, engineers, and developers to speak the same language is challenging. Coordination between different fields is difficult since values and objectives of collaborators may vary.
- It is important that collaborative teams keep cultural relevance in mind along with project goals/outcomes.

##### INTELLECTUAL PROPERTY CONCERNS

- Information sharing and project integration can introduce intellectual property issues for proprietary design techniques and approaches.

##### CONSENSUS BUILDING CHALLENGES

- Consensus building can be challenging if institutions are resistant to changing their established procedures and conceptual frameworks, and if collaborators have different opinions about what's best for children and the community.
- The legal aspects of setting up collaborations between large institutions are also challenging.
- It's impossible to meet all needs on a given site with a finite amount of space and resources, so compromise is always required. Collaborators need to be flexible enough to allow that.

##### COLLABORATION IN LEADERSHIP

- Leadership changes/turnover at school sites and among institutional collaborators means that there needs to be a convenient "on ramp" for including new voices. Ongoing professional development and thorough documentation are important.

- Leaders with big egos can prevent high quality collaborations.

#### SHARED LIABILITY FOR COLLABORATIVE PROJECTS

- Liability concerns are a topic that needs discussion among collaborators. Frequently, all that is needed is an assessment of insurance.

#### ACCESS TO SCHOOL SITES FOR NON-SCHOOL PERSONNEL AND COMMUNITY MEMBERS

- It's difficult for outsiders to gain access to the classroom to help teach in their own areas of expertise. (Teachers don't know who to call for help. People who want to help don't know who needs it.)
- Sometimes outside volunteers need to be fingerprinted if they will be onsite during school hours.

#### TIME

- Time constraints are real. It's often hard to find time to collaborate, even if interest is there.
- Teachers often lack time for professional development and lack time to develop and implement new curricula with their classes. (If outdoor lessons are standards-based, this is easier.)

